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A Report on an Application by Shell Canada Limited to Drill a Critical Sour Well in the Jutland (Castle River South) Area

June 1986

ENERGY RESOURCES CONSERVATION BOARD
DECISION REPORT

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1 THE APPLICATION AND HEARING

1.1 The Application

Shell Canada Limited (Shell) applied pursuant to Part 6 of the Oil and Gas Conservation Act for a licence to drill the well, SHELL JUTLAND 14-3-3-2 (the well), directionally from a surface location in legal subdivision 2 of section 10, township 3, range 2, west of the 5th meridian, to a projected bottom-hole location in legal subdivision 14 of section 3, township 3, range 2, west of the 5th meridian. The purpose of the well would be to evaluate the hydrocarbon potential of the Mississipian and Devonian formations. Shell estimates that if the well is successful and encounters sour gas, the maximum hydrogen sulphide (H_2S) concentration would be 32.7 per cent.

The location of the proposed well and key geographical and topographical features in the surrounding area are shown in Figure 1.

1.2 Preliminary Meetings

At about the same time the application to drill the well was received, a number of individuals and public interest groups expressed concerns to the Board regarding the proposed Jutland well. As a result, a meeting was held at the offices of the Board in Calgary on 31 October 1985 to discuss, among other things, the need for a public hearing of this application, the terms of reference for such a hearing, and the need for additional information and particulars to complete the application. The decision of the Board resulting from this meeting is detailed in a report dated 14 November 1985 and entitled "Memorandum of Decision; Procedures Meeting; Application 851037".

As a result of the 31 October 1985 meeting, the Board decided that there was a need for a public hearing of the application, and that certain additional information was required from Shell to supplement and complete the application. Further, the Board determined the terms of reference for the public hearing. In summary, the Board decided as follows:

- the hearing would not be for the purpose of reviewing the re-zoning decision made by the Government (this matter is discussed further in Section 2.2),
- the hearing would be for the purpose of considering the proposed Jutland well and its potential impacts, but not to consider impacts which might occur from possible future developments, and
- the Board would consider relevant matters that are within the Board's jurisdiction, which include
  - the need for the well,
  - safety precautions during drilling, and
  - the impact on the environment, including wildlife, of the proposed well and access road, but not including broad issues as to the present state or long-term management of wildlife in the area.

An additional meeting was held at the offices of the Board on 6 December 1985 to discuss the eligibility of some interveners for local interveners' costs. The results of this meeting are detailed in a report dated 13 December 1985 entitled "Memoradum of Decision; Local Interveners' Costs Meeting; Application 851037".

1.3 Interventions

The Board received interventions from a number of individuals and public interest groups including several groups based in Montana. The individuals included area residents, recreational users of the South Castle River area, and those with a commercial interest in the area. The views of the participants in the hearing are summarized in Section 4 of this report.

1.4 The Hearing

The hearing of this application was originally scheduled for 6 January 1986 in Calgary. As a result of requests by several interested parties for postponement and relocation, the hearing took place on 27-30 January 1986 in Pincher Creek before G.J. DeSorcy, P.Eng., L.A. Bellows, P.Eng., and E. J. Morin, P.Eng.

Table 1 shows those who appeared at the hearing.

2 BACKGROUND

2.1 South Castle River (Jutland) Area

The South Castle River Valley is located in southwestern Alberta approximately 30 kilometres (km) southwest of the town of Pincher Creek. The southernmost upper reaches of the valley form a portion of the northern border of Waterton Lakes National Park (Waterton Park). The proposed well site is located in this valley near the confluence of Font Creek and the South Castle River, as shown in Figure 2.

The valley landscape provides habitat for ungulate populations as well as large carnivores such as grizzly and black bears, and cougar. The South Castle River watershed also provides for a wide range of recreational opportunities such as hunting, fishing, hiking, and snowmobiling. The area currently experiences relatively low levels of recreational use due to limited access into the area.

Some salvage logging was conducted in the late 1970s which resulted in the construction of the road which now provides the primary access to the area. Reclamation attempts on the upper portion of this road have been partially successful.

TABLE 1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Shell Canada Limited (Shell) K. F. Miller	J. R. Tilbe, P.Eng. D. R. Brundrit, P.Eng. R. T. Staysko, P.Eng. J. D. Scott Dr. D. A. Mead R. Webb B. N. McLellan Dr. D. M. Leahey
Town of Pincher Creek (the Town)	Mayor, J. Teran
Pincher Creek and District Chamber of Commerce	F. Cook
Diamond Hitch Outfitters (Diamond Hitch) S. R. Miller	M. Judd Dr. B. L. Horejsi D. W. Mayhood
Alberta Wilderness Association (AWA) D. Pachal	R. Maw Dr. C. Jonkel M. Fairbarns J. Main E. Dunn Dr. V. Geist S. Marty
Timbermountain Packtrain	D. Simpson
G. Hoffman	
Pincher Creek Area Environmental Association (the Association)	S. Taylor D. McGlynn D. Blackburn
Parks Canada	B. Lieff B. F. Leeson M. Winkler
Waterton Biosphere Reserve Management Committee (the Committee)	L. Frith C. Russell B. Lieff
National and Provincial Parks Association of Canada (NPPAC)	D. Dodge
Sierra Club (Alberta)	D. Kariel
Sierra Club (Montana)	L. Kreck
L. Kreck	
R. Bailey	
Lethbridge Fish and Game Association	R. Goodwin
D. Sheppard	
R. E. Wolf	
Montana Wilderness Association	J. Frederick
Local 835 of the Energy and Chemical Workers Union (the Union)	L. Ferguson G. Dorge M. Cleland

TABLE 1 THOSE WHO APPEARED AT THE HEARING (cont'd)

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Pincher Creek Snowmobile Club (the Club)	R. Reed D. Reed G. Lang
* J. Tweedie	
* Glacier—Two Medicine Alliance	J. Jessepe
** Alberta Fish and Game Association	
** Federation of Alberta Naturalists	
** Great Bear Foundation	
** E. Jones	
** C. Wallis	
Energy Resources Conservation Board staff A. Gervais R. Cox, P.Eng. L. Holizki, P.Eng. B. Madu, E.I.T. D. Shaw Dr. R. Wallace	

* Denotes parties that were present for a portion of the hearing but were unable to remain to present their submission.

** Denotes parties that made submissions but were not present at the hearing.

Seismic operations conducted in the Font Creek area in the 1950s identified a potential structure for the trapping of natural gas. Although natural gas exploration has proven successful to the west in the Flathead Valley of British Columbia and to the east in the Waterton Gas Field, no drilling has been conducted in the South Castle Valley to date.

2.2 Castle River Sub-Regional Integrated Resource Plan

In 1977 the Alberta Government approved a document entitled "A Policy for Resource Management of the Eastern Slopes" (Eastern Slopes Policy). The purpose of the Eastern Slopes Policy is to provide direction for integrated resource management and planning for the entire Eastern Slopes region. This policy was revised in 1984. The Castle River Sub-Regional Integrated Resource Plan (Integrated Resource Plan) was approved by the Alberta Government in June of 1985 in acknowledgement of the importance of the Castle River area to watershed protection and recreation.

The Integrated Resource Plan identifies specific zones and the associated activities which may or may not occur within these zones. Within the South Castle Valley, three zones have been designated: a Prime Protection Zone (Zone 1), a Critical Wildlife Zone (Zone 2), and a General Recreation Zone (Zone 4). A designation of Zone 1 is intended to preserve environmentally sensitive terrain and valuable aesthetic resources for the maintenance of watershed and wildland recreation values. Accordingly, petroleum and natural gas exploration activities are not normally permitted within this zoning area, except under very special circumstances.

The Font Creek area in which the well site is proposed was designated as Zone 1 under the 1977 Eastern Slopes Policy. The 1984 revision to the Eastern Slopes Policy and subsequent approval of the Integrated Resource Plan in 1985 resulted in reclassification of the area of the well site as Zone 4. This designation provides for the protection of watershed, wildlife habitat, and recreational resources. Petroleum and natural gas exploration and development as well as timber production are allowed under special conditions and controls to ensure preservation of recreational opportunities. According to the Integrated Resource Plan, access is to be highly restricted to protect the wild land character of the adjacent Zone 1 and to ensure maintenance of an adequate buffer to Waterton Park.

The South Castle area and associated zoning relative to the proposed well site are shown in Figure 2. Further information regarding the plan and associated zoning can be found in the Alberta Energy and Natural Resources publication "Castle River Sub-Regional Integrated Resource Plan".

3 BASIS FOR DECISION

As indicated in Section 1 of this report, the Memorandum of Decision resulting from the 31 October 1985 pre-hearing meeting dealt with the terms of reference for the hearing. The memorandum stated the principle that the Board would consider only those matters which are within its jurisdiction and relevant to the application, and on the basis of the representations made at the 31 October meeting, it set out terms of reference which have been summarized in Section 1.2.

Notwithstanding that a number of participants in the hearing suggested otherwise, the Board is satisfied that the terms of reference established in the Memorandum of Decision are still appropriate. That view is reflected in this section of the decision report which identifies and elaborates on the issues which the Board believes it should address in deciding the application.

The first matter to be reiterated is that the Board does not consider itself to have jurisdiction respecting land zoning designations under the Alberta Government's Eastern Slopes Resource Management policies. The lands on which the proposed well would be located are zoned as General Recreation, which allows for petroleum and natural gas exploration and development under special conditions and controls. The Board is firmly of the view that the matter of the zoning of the land is not an issue to be dealt with in its decision on the application.

A number of participants in the hearing argued that more detailed environmental data was needed and that the Board should have regard for possible future developments in the event the proposed well is successful. The Board indicated in the Memorandum of Decision that it would consider the impacts on the environment of only the proposed well and access road as opposed to possible future developments. For that reason, it also stated that only a general assessment of impacts on the environment, rather than detailed environmental studies, would be required of Shell to complete the application. The environmental information provided by Shell prior to the hearing met that requirement.

The Board remains of the view that, since the well would be exploratory in nature, there is great uncertainty as to whether it would encounter hydrocarbons. It recognizes that there would be little purpose in licensing and allowing a single exploratory well to be drilled if it was clear at the outset that follow-up development and production would not be feasible. This is not the case for the proposed well in that the Government's Integrated Resource Plan designates the lands in question as being suitable for natural gas exploration and development under special conditions and controls.

For the above stated reasons, and because there is no certainty as to the type of future developments which might be proposed, nor indeed that any would be proposed, the Board confirms that it will make its decision solely on the basis of the drilling of the proposed well including construction of the proposed well site, upgrading of the access road, and a possible limited production test.

It is important to note that any possible future developments, be they additional wells, pipelines, or other facilities, would require further application to the Board. The applications would be subject to public review at the time they are made. Respecting the contention that the present application should not be assessed on an "isolated" basis and that the possibility of future developments should be evaluated as part of it, the Board, as indicated earlier, does not agree. However, if the proposed exploratory well is approved, proceeds, and is successful, and if substantial follow-up developments are planned, the Board would not expect to consider future applications on a single-application basis. Additionally, depending on the extent of any future proposed developments, the Board might require more detailed environmental data.

In dealing with this application, the first issue the Board will address is

- the justification or need for the well.

In this respect, the Board does not consider the test to be one of whether the drilling of the well is an absolute requirement on behalf of society. Rather, the Board sees this issue as dealing with the intended purpose of the well and to some extent as a measure of the benefits which society could derive from the well, if successful. It is against these potential benefits that the "costs" of the well, including threats to public safety and impacts on the public and the environment, must be weighed. In assessing these costs, the Board will address

- the potential impacts on the environment of the drilling and possible limited testing of the proposed well at the proposed site and of the access road, and
- mitigative measures which might be taken to reduce such impacts.

The "environment" in this respect includes the land, surface waters, air, vegetation, fish and wildlife. However, it must be again emphasized that the Board will be assessing only the impacts of drilling the specific applied-for well and the proposed access road and will not be reviewing potential long-term impacts which could result from possible future developments. It should also be noted that there are elements of these impacts and possible mitigative measures where the Board does not believe it has jurisdiction, such as the location of the access road or its method of construction. Where relevant to the assessment of the application, the Board will identify and comment on these elements in this decision report.

The lands in question are used by the general public for recreational purposes such as hiking, hunting, and fishing and by commercial users such as licensed guides and outfitters who bring clients into the area primarily by horse train. The Board will thus look at

- the potential impact of the proposed well and access road on commercial users, and
- the potential impact on non-commercial recreational users.

The former would not be for the purpose of assessing any possible compensation, but only for determining the overall costs to society that could result if the well were drilled.

In dealing with the subject application, it must also be recognized that the proposed well would be a critical sour well as defined by the Board in Draft Interim Directive ID 84- , "Blowout Prevention at Sour Wells". This is because of the high H_2S release rate which could potentially take place from the well, and also because it is located in a recognized recreation area where development and production of oil and gas resources would be permitted only under special conditions and controls.

Having this in mind the Board will next assess

- the precautions to be taken during the drilling of the well to safeguard against the possibility of a blowout, and
- the actions to be taken in the event of a blowout and the impacts that might result.

Finally the Board, as it did in its Memorandum of Decision, emphasizes that it has jurisdiction to deal only with the Alberta public interest. Accordingly, it will limit its examination to evidence which relates specifically to the public interest of the province and its citizens and will deal with potential impacts beyond the provincial boundaries only to the extent that such impacts would affect the public interest of this province.

4 POSITIONS OF THE PARTICIPANTS

The Board received written submissions from 27 intervening parties of which 20 made verbal presentations at the hearing. Of the 27 interveners, 4 supported the Shell application. This section summarizes the views or positions of each participant.

4.1 Shell Canada Limited

Justification for the Well

Shell stated that seismic studies suggest a drillable prospect exists in the Jutland or South Castle area. It acquired the appropriate petroleum and natural gas licence from the Alberta Crown in 1969, but was unable to acquire surface access until approval of the Integrated Resource Plan in 1985. Shell stated that its objective is a potential deep natural gas accumulation similar to but significantly smaller than the Waterton Field. It stated that there could be as many as four prospective horizons in two thrust sheets, comprised of one Mississippian and one Devonian formation in each sheet. It said the well is located in the optimum location to test the lower sheet and find out if it contains Devonian rock, and also to determine if the upper sheet exists by drilling through a small piece of it.

Shell stated that the well was exploratory in nature with about a 10 per cent chance of success, but estimates that the prospect could be as large as 40 square kilometres (km^2) with possible gas reserves of up to 8450 million cubic metres.

Shell stated that its major business is oil and gas production and therefore to stay in business it must replace depleting gas reserves, both for itself and for Canada. Although there was some discussion that a discovery at Jutland and subsequent production would replace declining reserves at its Waterton Gas Plant, Shell emphasized that the proposed Jutland well was for exploratory purposes only and should not be considered in relation to present gas processing capabilities at the plant.

Shell stated that it was currently drilling a well in British Columbia, SHELL GROUSE 8-75-G-82-G-1 (the Grouse well), for similar objectives and indicated that if this well failed to encounter Paleozoic rock, the proposed Jutland well would not be drilled. Shell anticipates information from the Grouse well to be available by September or October of 1986, but indicated that approval of the current application is required now to provide a window of opportunity for lease and access road construction from July to December of 1986.

Construction and Reclamation

Shell stated that prior to obtaining its Mineral Surface Leases (MSL) from the Government for lease and access road construction and occupation, it had consulted with regulatory agencies and had submitted a report of its initial environmental investigation. It said that no surface disturbances would occur in the South Castle or Font Creek area until the well licence was approved and the decision to drill the proposed Jutland well, pending the results of the Grouse well, was made. Shell added that all construction would be done in a professional manner under Shell's supervision with close co-ordination with regulatory agencies to minimize the disturbance.

Shell identified four different construction activities, the access road, well site, campsite, and drilling waste disposal site. Regarding the access road, Shell stated that there is existing access from the junction of Highway 774 up to and beyond the well site depending on the mode of transportation and the seasonal surface conditions. The present and proposed access roads are shown in Figure 2.

Shell suggested that access by conventional vehicle is now possible to the Scarpe Creek junction, and beyond this point with four-wheel drive or all-terrain vehicles. For the purpose of drilling the proposed well, the first 9.3 km of the 27.8-km access road would require some slight regrading and the next 11.5 km would require some upgrading. The next and final 7 km would be over a previously abandoned and reclaimed road and would require rebuilding, with a portable bridge installed to cross the Castle River. Shell proposes the construction of an all-weather road requiring gravel in selected areas only, and would apply a wetting agent for dust control when required. A locked steel gate would be located at Scarpe Creek for access control, and would be manned during the drilling activities.

Shell's mineral surface lease is for a well site of 140 metres (m) by 140 m on an existing cleared area situated on a 15-degree slope. The well site would require some excavation and levelling. Shell proposes to use buried steel tanks as opposed to an on-site sump for containment of drilling fluids. These drilling fluids would be transported to a remote waste disposal site during drilling. The well site would also be bermed to contain any spillage and avoid runoff from the lease.

Shell proposes to locate the remote drilling waste disposal site approximately 600 m north of the well site in an existing cleared area. The site would be approximately 100 m by 100 m and Shell believes that the soil is suitable for a containment pit. Shell proposes to transport drilling waste from the well to this site, and treat and dispose of this material in the conventional fashion. Shell stated that the perimeter of the site would be fenced and the gate locked to keep out people, wildlife, and cattle.

Shell proposes a camp located near Scarpe Creek to house and feed 30 to 40 drilling personnel for the duration of the drilling of the well. A helicopter for use in emergency situations and infrequent reconnaisance would be located at the camp. Crew transportation from outside the South Castle area to the camp, and from the camp to the well site, would be by personnel carrier to minimize traffic. The possession of firearms, alcohol, drugs, and motorized recreational vehicles at the campsite would be strictly prohibited. Domestic camp sewage would be contained in closed below-ground tanks with the effluent transported regularly to an approved disposal site. Combustible garbage would be incinerated with government-approved incinerators with spark arresters, while non-combustibles would be transported to approved disposal sites.

Shell presented a number of reclamation scenarios depending on whether the proposed well resulted in a dry hole and discontinued access, a significant discovery and continued access, or a marginal discovery with a suspended well requiring intermittent access. Reclamation procedures and corresponding access would be in accordance with the conditions of the MSL but, in general, would involve recontouring, stabilization, and redistribution of salvaged topsoil over the disturbed area. The area would be revegetated with an approved fertilizer-seed mix and legumes, with salvage deadfall spread over the surface to control erosion, enhance vegetation, and restrict access. In some instances local shrubs and seedlings would be planted to accelerate revegetation. Measures planned for access control vary depending upon the scenario, but Shell proposes to restrict access as much as possible. Shell added that snow-plowing and maintenance of the access road would cease when Shell was not active in the area.

Wildlife

Shell stated that it has long recognized the South Castle as an important wildlife and recreational area. It also recognizes the grizzly bear as a rare species, with low population density subject to slow growth. Mr. B. McLellan appeared on behalf of Shell as an expert in grizzly bear behaviour and identified three ways in which these bears could be affected. These are through habitat loss, displacement by human activities, and human-induced mortality.

Mr. McLellan said that given the existing road right of way and cleared area, habitat loss would be minimal.

Mr. McLellan indicated that there was a variance between individual bears and how they would react to roads, but generally they would avoid them by 50 to 200 m. Around the well and campsites, he suggested that avoidance could be expected in the range of 400 to 800 m. Given the existing access road and use of the area, he estimated that further displacement because of the well, camp, and access road for the 1-year drilling period would be minimal.

Mr. McLellan predicted that human-induced mortality would account for 95 per cent of the potential impact. He added that most grizzly mortalities result from legal hunting, poaching, and conflicts with man due to real and perceived protection of life and property. He said that mortalities due to these causes tend to increase very rapidly with road access.

Mr. McLellan noted that Shell proposes to restrict access and stated that if it does a good job, the long-term impact would be minimal. He added that Shell's proposals for garbage incineration and control of firearms would reduce human-bear confrontations and reduce the risk of human-induced mortality. In the event of such confrontations, Shell stated it would not kill the bear, but rather it would have the bear removed from the area if necessary.

Regarding the effect of drilling and construction activities on other big-game animals of the area, Shell stated that there was limited potential for interaction between the project and bighorn sheep or mountain goats as the closest known range for these animals was greater than 1 km from the well site. Mr. R. Webb, appearing on Shell's behalf as an expert on wildlife other than grizzly bears, estimated that the effect of stress as a contributor to sheep bacterial pneumonia would not be significant. He acknowledged that there would be greater potential for interaction with migrating or summer resident moose, elk, and deer with the well site and road, but suggested they would adjust quickly if not harrassed. Shell added that it would equip its vehicles with high-frequency whistle devices to alert animals on the road and prevent road kills.

Shell stated that it would minimize traffic and helicopter disturbances in the Font Creek Valley near the proposed well site. It added that habitat loss and disturbance of migration could be expected only during snow-free seasons due to lack of wintering habitat. Habitat loss would eventually be restored and, in the case of site abandonment, movement patterns would be reinstated. It also added that, based on Shell's drilling waste disposal and handling procedures, no effect on animals from toxic materials is expected.

In response to questions, Shell said that while the probability of encountering great grey owls along portions of new right of way was low, it might be worthwhile to check this situation. Regarding the long-toed salamander, Shell stated that it would not likely be found at the elevation where the proposed disturbances would occur. Shell concluded that its proposed mitigative measures, particularly regarding limited access, would prevent significant or long-term impacts on wildlife.

Plantlife and Fisheries

Shell said it recognizes that the southwest corner of Alberta has a great diversity of plants and plant communities. However, the majority of these are not actually rare or unique because they are outliers of ranges that extend into British Columbia or the United States. Shell said that, through discussions with the Resource Planning Branch and Public Lands Division of Energy and Natural Resources, only one ecologically unique plant community was identified near the proposed Shell activities. This is the Big Sagebrush community along the southwest slope of Whistler Mountain. Whereas it acknowledged that individual sagebrush plants may be located near the proposed access road, Shell stated that the bulk of the community and area being considered for an ecological reserve would not be adversely affected.

With respect to the fisheries of the South Castle area, Shell said that the effect of siltation due to road construction would be minimal, since construction is proposed for the fall when water flow is generally low. Siltation effects would thus be local and intermittent. Shell indicated it did not recognize the Scarpe, Jutland, or Font Creeks as important fish-bearing habitat. It added that the only crossing of such habitat would be of the South Castle River by bridge rather than culvert and fill, to minimize siltation.

Regarding native bull trout, Shell noted that it was still abundant in a number of streams and does not consider it to be a rare species. It admitted that the species is susceptible to over-fishing, but suggested the fishing pressure would be reduced during and after drilling as a result of the road closure or access restrictions.

Commercial and Recreational Use of the Area

In response to concerns of the commercial outfitters, Shell noted that the area of the road and well site is already disturbed. It added that the drilling would occur in less than a 1-year period and the area would not appear appreciably different than its present state. Shell noted the locations of trails commonly used by the outfitters are never closer than 2 km from the proposed well site and that the well site would only be visible from a short section of the trail. Odours and noises from the rig would not likely be detected at these distances. Shell also stated it would work with

Timbermountain Packtrain to ensure the drilling and construction operation did not impair its campsite at the junction of the Font Creek and Castle River, but had no comment with respect to the outfitters' base camp at Scarpe Creek.

Regarding trapping operations of Mr. Hoffman, Shell acknowledged that a short-term interference along the access road may occur. In particular, Shell recognized that winter road use could result in a change of movement patterns of furbearers, but believed it would not result in total range abandonment. Shell stated that it was prepared to discuss and resolve Mr. Hoffman's concerns.

Shell noted the considerable recreational use of the area, particularly between Beaver Mines and Scarpe Creek in July and August, with some snowmobiling and cross-country skiing in the winter. The trails, cutlines, and logging roads south of Scarpe Creek are also subject to significant hiking and motorized activities of a recreational nature. Shell acknowledged that during the possible brief production testing of the proposed well, some odours may be evident for a short period of time, and that some recreationalists using the immediate area would see or hear the drilling operations.

Shell stated that although a requirement of its MSL is to close the road south of Scarpe Creek, it had no jurisdiction over how people would otherwise enter the area. Shell proposes a system of registration boxes and informational pamphlets to make backcountry users aware of its operations and to make it aware of their presence. This system would commence approximately 2 weeks prior to drilling into the critical zone (i.e. the formations which could contain large volumes of H_2S) and would be implemented at seven trail locations. Regarding concerns of skiers and snowmobilers wanting continued winter access to the valley, Shell stated that it would be willing to discuss this matter with the appropriate authorities.

With respect to concerns regarding Waterton Park, Shell noted that the proposed location is approximately 5 km from the northwest corner of the Park. The location lies behind Sage Mountain so neither the drilling location nor access road would be visible from the Park, nor would the drilling operation be heard. Shell acknowledged that the location is within the zone of co-operation established by the Waterton Biosphere Reserve Management Committee, but noted that both the Committee and Parks Canada had recognized that no unacceptable negative impacts to the Park would likely occur if reasonable precautions were taken. Shell added that it would continue to meet with Park staff to avoid negative effects to the Park.

Drilling Plan

With the Mississippian and Devonian formations as its objectives, Shell anticipated drilling to a depth of 5625 m. It proposes to drill a surface hole to a depth of 600 m with foam as the drilling fluid. Surface casing would be set and cemented full length. Based on offset well information, minor lost circulation is possible but no gas is expected.

Intermediate hole would then be drilled to the top of the Cretaceous formation using air as the drilling fluid, at which point the drilling fluid would be converted to a fresh-water mud system. Drilling would then continue through the Cretaceous to the top of the first Mississippian objective at 4440 m. A portion of this interval would be drilled directionally. Shell believes that lost circulation is possible in the Cretaceous, but notes that no sour gas zones are expected. At this point Shell proposes to set intermediate casing and cement it in accordance with Board requirements.

Shell then proposes to drill the main hole through the first Mississippian and, if it exists, the first Devonian objective to the top of the second Mississippian objective anticipated at 4750 m. Shell stated that if a full sheet or evidence of porosity or gas was encountered, casing would be set across this sheet. It expects normal pressures and minor or no lost circulation. Drilling would then continue through the second Mississippian into the second Devonian objective. Shell again anticipates normal pressures and minor or no lost circulation. Throughout the drilling of the intermediate and main hole, both barite and lost circulation material would be stockpiled on location.

Shell stated that the drilling of the well would take approximately 275 days, the last 83 days of which would be in the critical zone. Shell said that it anticipated spudding the well in November of 1986 which would result in drilling the critical zone during June through August of 1987.

In response to questions, Shell stated that production testing of the well would be performed through a packer and tubing arrangement rather than a conventional drill-stem test. Testing of a single zone could take up to 2 weeks, of which actual flaring would be 2 to 4 days. Shell suggested there could be two such tests on this well.

Shell noted that its proposed setting depth for intermediate casing is in excess of the Board's 3600-m requirements but considers this appropriate due to the expected competency of the rock at 4400 m. The design of the intermediate casing satisfies the Board's requirements for tension, burst, and collapse, and would be of grades suitable for sour service. In response to concerns of Diamond Hitch Outfitters regarding the adequacy of the casing design, Shell reiterated that it met Board design requirements for intermediate casing and may be appropriate for production depending on actual pressures encountered. Casing wear tests would be performed to determine the integrity of the intermediate casing prior to determining whether full length production casing or a liner would be used for production purposes.

Shell indicated that the depth of the proposed Jutland well would necessitate the use of relatively high strength drill pipe. It proposes to use a combination of X-95 and G-105 drill pipe. The X-95 pipe is softer and less susceptible to sulphide stress cracking than the S-135 drill pipe suggested in the Shell application. The X-95 pipe would be new pipe while the G-105 string would be Class II or almost new. Shell stated that in addition to other inspection methods, each joint of drill pipe would be hardness tested in accordance with Blowout Prevention Review Committee (BPRC) recommendations to eliminate unusually hard joints.

Shell proposes to use a Blowout Prevention (BOP) stack and choke manifold assembly rated to 34.5 megapascals and manufactured from materials conforming to the National Association of Corrosion Engineers (NACE) MR 01-75 standard for sour service suitability. The BOP stack is to be consistent with the recommendations of the BPRC and will consist of two pipe rams, one blind shear ram, an annular preventer, and two drilling spools. The pipe rams could be used to seal off the well with drill pipe in the hole, while the blind shear rams are designed to close an open hole or, if necessary, shear the drill pipe and completely seal the hole. Shell also proposes to have a ram blanking tool available to convert a pipe ram to a blind ram if required. Regarding the effectiveness of shear blind rams on higher strength pipe, Shell indicated that although they were aware that third-party testing on X-95 drill pipe had been conducted successfully, actual testing on the proposed X-95 string would be conducted prior to drilling.

The mud program proposed by Shell provides for a stockpile of basic zinc carbonate for H_2S scavenging on location. However, Shell stated it did not intend to pre-treat the mud for the intermediate or main hole. Shell indicated that unless abnormal pressures were expected, it preferred to rely on the high pH of the drilling fluid for drill pipe protection and as the primary indicator of a sour gas influx. If a reduction in pH is experienced, it would treat the mud as necessary.

Shell indicated that the surface volume of mud available in the active system would be at least equal to the hole volume throughout the drilling of the main hole. In addition, a standby mud system would be used and would contain approximately 30 per cent of the anticipated hole volume. Mud system equipment would include two mud-gas separators, two independently powered mud pumps, and two hoppers with centrifugal pumps and associated transportation system to mix at least two sacks of weight or lost circulation material per minute.

Shell's proposal for kick detection and monitoring includes having a mud logger on location for gas detection purposes from the top of the Cretaceous. In addition, Shell stated that the drillers would monitor drilling parameters and the rig would be equipped with an electronic mud tank monitoring system and flowline sensors consistent with BPRC recommendations. Continuous pH monitoring and H_2S ambient detection devices would be used while drilling through the critical zone. Shell does not propose to use third-party electronic monitoring.

Shell stated it would have excellent crew training and supervision on this well so that any dangerous situation would be detected early and treated before it becomes a well-control problem. Shell's Drilling Foremen would have Level II Well Control Certification, H_2S Alert, and First Aid training. BOP checks would be conducted daily and BOP drills weekly. In addition, flow checks would be conducted while tripping and extra precaution would be exercised while tripping after a coring operation.

Emergency Response Plan

Based on its geological interpretation of the region, Shell considers the proposed Jutland well to be an analog of the Waterton Sheet 4 zone. Accordingly, it used Waterton Sheet 4 data to estimate potential H_2S release rates for emergency planning purposes. Shell considered Absolute Open Flow Potential (AOFP) data from the wells, Waterton 42 and Flathead 3, as representative of the highest flow rates experienced in their respective fields. The H_2S concentration of 32.7 per cent over Waterton 41 was submitted as the highest in the Waterton Field. Shell estimated AOFP data for Jutland by extrapolating original reservoir pressures to the Jutland depths. Based on the worst-case Waterton data and assuming the upper sheet would be cased off in accordance with the drilling plan, a maximum H_2S release rate of 13.3 cubic metres per second (m^3/s) was estimated.

Shell identified two areas or zones of importance with respect to its emergency response plan, these being the emergency planning zone and the emergency awareness zone.

The emergency awareness zone is an arbitrary area in which people would be made aware of drilling and emergency plans and would include Waterton Park, the closest residences to the east in Shell's Waterton

Field, and the area to the northeast of the drilling camp in the South Castle River Valley.

The emergency planning zone is the area closer to the well proposed for evacuation in the event of a well-control situation. It was determined based on a calculated maximum plume rise, under neutral atmospheric conditions using the Briggs Model, of 1000 feet above the well site. The emergency planning zone was determined as a trace of this topographical elevation. Shell considers this analysis to be extremely conservative for planning purposes.

In addition to these calculations, Shell employed Dr. D. Leahey as a consultant to use dispersion models to estimate the position of H_2S isopleths under blowout conditions and local atmospheric conditions. Dr. Leahey's calculations for the H_2S release rate of 13.3 m^3/s resulted in 100 parts per million (ppm) and 20 ppm downwind isopleths of 2.3 and 11.0 km respectively. The 100 ppm isopleth and Shell's emergency planning zone are shown in Figure 3.

The ignition criteria proposed by Shell were that if H_2S concentrations greater than 20 ppm are measured at the closest residence, or if Shell is unable to search and ensure the emergency planning zone is evacuated of transients, or well control is not achievable in the short term, the well would be ignited. Additionally, if concentrations reach 50 ppm in the downwind valley, the well would be ignited. Intentional ignition might also occur at sustained levels of 20 ppm in the valley, dependent on rig operations and crew safety.

Under questioning regarding its ignition criteria, Shell agreed that under a total blowout situation in which there is no method of gaining immediate control, the well should be ignited immediately unless it is assured that the emergency planning zone is evacuated and, in addition, monitoring is taking place off-lease in a downwind direction and no readings exceed 50 ppm. Shell stated that immediate control meant a period of 1 to 2 hours. Given the problems of assuring complete evacuation of the planning zone, Shell agreed that, in the case of total lost control, it was almost certain that the well would be ignited within 1 hour.

In the event of a partial blowout or leak, Shell stated that it would monitor the area and attempt to bring the well under control. If well control was not achievable in 1 or 2 days and 50 ppm were detected in the planning zone, the well would be ignited. Shell added that if long-term exposure were to occur, it would ignite the well if H_2S concentrations of 20 ppm were measured in the planning zone. Regarding low concentrations due to a leak or partial blowout, and odour problems but no serious health risks in the Park, Shell indicated that ignition would be considered and would require discussion with Board, Forestry, and Park officials.

In response to concerns of interveners about the method of monitoring H_2S concentrations in the valley, Shell stated that monitoring would be performed by personnel with Draeger units. Monitoring would begin at the well site and continue downwind at various points along the access road, then be continued upwind. Shell indicated that concentrations of 50 ppm very near to the lease would not necessarily result in ignition, but the well would be ignited if this concentration was detected 1 km or more from the well site. Responsibility for ignition under these circumstances would rest with the on-site supervisor. In response to concerns regarding the authority of a Drilling Foreman to proceed with the ignition of a drilling rig worth approximately 3 million dollars, Shell stated that it regularly places a lot of responsibility with these individuals and they are qualified to make this decision.

Shell identified three components to the implementation of its emergency response plan. The first would be the pre-plan stage in which, prior to drilling, it would review the plan with appropriate government agencies and finalize it. The Drilling Foreman would notify the Chief Park Warden of Waterton Park, the local Forest Ranger, local Fish and Wildlife Officer, local outfitters and trapper, Shell Waterton Complex Manager, and the owner of Castle Grazing Allotment #89 when drilling has commenced. The emergency response plan would be reviewed again prior to drilling out of the surface casing, and again prior to entering the critical zone. During the drilling of the critical zone, Shell proposes to supply all the aforementioned parties with weekly status reports of drilling progress.

As mentioned previously, Shell proposes to maintain a transient awareness program and it would equip the outfitters with radios for direct contact.

Shell stated that a Stage 1 alert would be initiated upon experiencing significant lost circulation, a kick situation, or continuous gas cut mud. This would result in helicopter surveillance of both the planning and awareness zones, assessment and precautionary evacuation of transients within the planning zone, and activation of monitoring stations at the rig camp, Red Rock Canyon gate, and the nearest residence to the east. In addition, Shell and government personnel would be mobilized, and the access road and trails would be blocked.

A Stage 2 alert would result from the well experiencing an uncontrolled flow or uncontrolled flow being imminent. Helicopter warning messages would be given every 5 minutes in both the planning and awareness zones. Alberta Forestry would be notified, the Emergency Task Force dispatched, and the well-control and emergency control centres activated.

4.2 Town of Pincher Creek

The Town of Pincher Creek supported the proposed Jutland well on the basis that the discovery of new reserves would support the local economy. The Town said the well would have minimal impact as it is located in a previously logged area and the access road is already in place, requiring only minor improvements. The Town also stated that restricting the use of the improved road during the drilling period would probably decrease the amount of traffic in the area.

4.3 Pincher Creek and District Chamber of Commerce

The Chamber of Commerce supported the proposed well on the basis that new reserves would provide an economic stimulus to the local economy. It noted the possibility of a severe economic setback in the event of a slow-down or shut-down of the plant due to declining reserves of the Waterton Field. It added that long-term operation of the plant has a significant impact on the local economy, and that it did not believe the proposed application would impair tourism in the area.

The Chamber of Commerce admitted that there could be some negative impacts associated with the proposed well, but stated that the area in question is not prime wilderness area, having been previously logged and with an access road for the most part already in place. It also suggested that the locked gate at Scarpe Creek should discourage the general public from intruding farther into the area.

4.4 Local 835—Energy and Chemical Workers Union

The Union, which represents the hourly-paid employees of the Waterton Gas Complex, supported the application, stating it would offer its members long-term job security if the proposed Jutland well was successful, or at least give an indication of their future in the industry if it was not. It noted that many of its members were also concerned that the area be preserved as closely as possible to present conditions, and it had no doubt that Shell would follow the guidelines and methods of operation presented at the hearing. The Union added that Shell standards and methods of operation are far more stringent than those set out in legislation. Given the stringent controls for drilling, camp location and operation, and use of the service road, it is satisfied that the area will retain its present recreational value.

4.5 Pincher Creek Snowmobile Club

The Snowmobile Club supported the application as long as reclamation and clean-up would be successful. The Club said that as Shell is in the oil and gas exploration business, Shell should be allowed to explore the Jutland area, knowing it would do the utmost to minimize impacts. The Club does not consider the proposed well to be detrimental to summer or winter recreationalists under the imposed stringent requirements. It added that logging or natural causes such as fire or beetle-kill have resulted in more unsightly situations, and that the proposed well site would result in a minimal disturbance of timber and wildlife cover.

The Club was concerned that plowing the access road during the winter would make snowmobiling in this area more difficult and hoped that some alternative snowmobile access route into the valley could be established. It was also concerned that the use of the locked gate could close part of the area to all but a few exclusive individuals. It stated that everyone is entitled to use the backcountry, and that the gate should not be located any farther north than the proposed Scarpe Creek location.

With respect to safety concerns, the Club said Shell has been extremely careful with gas leaks or blowouts, and it expects Shell would uphold safety standards.

4.6 Diamond Hitch Outfitters

Diamond Hitch Outfitters intervened as a local trail riding operation in the South Castle Valley. Mr. and Mrs. Judd indicated that they had been involved in trail riding or hunting expeditions in the area for 18 years, and have held a commercial trail riding permit since 1980 when such permits were first issued. They opposed the well based on a number of concerns.

Diamond Hitch questioned the need for the well given the current processing situation at the Waterton Gas Complex and the current gas market surplus. It stated that the application should be denied until a need is shown for reserves to sustain the plant, because to allow this amount of disruption for an exploratory well would be inappropriate.

Diamond Hitch presented Dr. B. Horejsi as a witness on the potential impact of the operations on the grizzly bear. Dr. Horejsi indicated that the grizzly is a large-ranging animal with adult males having home ranges of up to 1000 km^2. As a result, no single jurisdiction is likely to contain a population solely within its boundaries. Due to the grizzly's slow maturation, no more than 2 per cent of reproducing females can be removed from a population without causing a decline in that population. Dr. Horejsi added that most bear mortalities are related to conflicts with man, the majority of which are related to access concerns. He stated that Shell's claim that there would be no impact on the grizzly bear from the proposed development is not substantiated and ignores a vast body of information indicating the opposite.

Dr. Horejsi indicated that the proposed upgrading of the road would be detrimental to the grizzly bears by providing increased access for hunting and poaching. He presented evidence of man-caused bear mortalities in the general South Castle area that indicated approximately 25 per cent of kills from 1982 to 1984 inclusive were by poaching.

Dr. Horejsi stated he knew of other areas that had tried locked or manned gates with no success, and could not cite an instance where road closure had been effective. He acknowledged that the proposed gate may prevent some seasonal or midwinter use of the area south of Scarpe Creek, but stated that this would not compensate for the increase in the use of the area up to that juncture. Regarding alternate gate locations, Dr. Horejsi did not believe conditions for the grizzly bear could be improved with road closure anywhere along the road. The potential impact of the proposed road would be to eliminate the grizzly bear as a resident population on provincial lands in Southwest Alberta, and to significantly impact grizzly bear populations in Waterton and the entire Northern Continental Divide Ecosystem.

Regarding the fisheries of the area, Mr. D. Mayhood, a biologist who appeared on behalf of Diamond Hitch, identified the South Castle drainage area as important rearing grounds for native cutthroat and bull trout. He stated that the population of native strains of these species in Alberta are declining due to a combination of fishing pressure and hybridization. Mr. Mayhood said that the South Castle area bull trout and possibly the cutthroat trout would be reduced to remnant populations due to increased angling and poaching pressure arising from increased access. Legal catch limits for bull trout have recently been reduced in the province, reflecting recent findings of population decline.

Mr. Mayhood also expressed concerns regarding siltation effects due to the proposed road construction, suggesting that eggs and larvae could be severely impacted by localized high sediment loads. He noted that Shell has not identified fish spawning and rearing areas in relation to construction activities.

Mr. Judd presented evidence regarding the potential impacts of the proposed well and access road on his trail riding operation. He stated that wildland is an essential part of his business as his clients come to see the country the way it has always been. He added that most come from urban centres and do not want to see a well site or other industrial development.

Mr. Judd stated that the rig would be visible from a few locations along his trails at distances of 1 to 5 km and was concerned that the rig noise and the sighting of it would detract from the wilderness experience of his clients. He added that Shell's rig camp would be visible from one of the horse trails he often uses. Mr. Judd noted that he currently uses a portion of the road that would be rebuilt, and stated that although four-wheel drives occasionally use this portion, it is essentially a single-horse trail.

Mr. Judd expressed concern with the improved access to the area, particularly with respect to potential impingement on his base camp located about 10 km down the South Castle road. He indicated that although the base camp is less than 1 km from the existing road, he is not bothered by present motorized use.

Mr. Judd admitted that the drilling of this proposed well was not his main concern, but rather it was the potential for future developments. Mr. Judd stated that although he understands Shell has every intention of reclaiming the area and believes they can do it, if a producing well is drilled the access will remain greatly increased and result in a detriment to his business.

Diamond Hitch expressed a number of concerns regarding Shell's proposed drilling plan. In particular, it questioned the adequacy of the intermediate casing design with regard to its potential for use as a production string. It noted that the casing burst calculations of the intermediate string is based on the setting depth and suggested that it would be more prudent to design the casing based on the projected total depth of the well. In addition, it questioned the ability of the upper sections of intermediate casing to withstand bottom-hole pressures.

Similarly, Diamond Hitch was concerned about numerous aspects of Shell's emergency response plan. It questioned the reliability of Dr. Leahey's H_2S dispersion and isopleth calculations, particularly with respect to H_2S release rates. It suggested there would be a possibility of the proposed well encountering reservoir rock similar to Waterton Sheet 3 which, by nature of its fractures, would result in higher flow rates than the Waterton Sheet 4 on which Shell based its release rates. Diamond Hitch contended that Shell must have regard for Waterton Sheet 3 data in its emergency planning. It also questioned the atmospheric conditions on which Dr. Leahey's calculations were based.

Diamond Hitch also expressed concerns regarding Shell's ignition criteria, particularly with respect to the method of monitoring the valley for the 50 ppm concentration for ignition. It suggested that the lack of defined locations for monitoring within the valley was too subjective, and identified a need for clearer definition of ignition criteria and the responsibility of Shell personnel to order such ignition.

Regarding evacuation measures, Diamond Hitch questioned the ability of Shell to ensure evacuation or rescue of transients under various light and weather conditions.

4.7 Alberta Wilderness Association

The Alberta Wilderness Association is a public interest environmental group with a long-standing interest in the South Castle area. The AWA opposed the well on the basis of a number of issues.

The AWA stated that there is a lack of justification for the proposed well in the socioeconomic sense and that benefits to the public of rejecting the application outweigh those of approving it. The AWA contends that an economic assessment should be done to provide an indication of the magnitude of economic and social benefits which would be lost to the public through loss of recreational and tourism values if the well were to be approved. It stated that there is a definite need for wildlands but no shortage of sour gas for the available markets, adding that Shell has other opportunities for drilling outside the South Castle watershed.

The AWA stated that the proposed activities would have unacceptable detrimental impacts on ungulate, grizzly bear, and bull trout populations of the area. The proposed well and access road would result in wildlife removal due to hunting and poaching as well as avoidance of prime habitat.

With respect to bull trout populations, the AWA believes the proposed access road would result in siltation of breeding grounds and increased fishing pressure, noting that this species is particularly susceptible to overfishing and that provincial objectives are to increase native bull trout populations.

It also expressed concerns regarding potential impacts on rare vegetation species in the area, particularly the Big Sagebrush community. The AWA was further concerned about the potential spread of noxious weeds such as knapweed due to the disturbance of the natural habitat.

The AWA was particularly concerned about the proximity of the well to the Waterton Park, both from the standpoint of wildlife using both the Park and the South Castle area, and also from the standpoint of the Park itself. It claimed that there is an increasing responsibility to recognize and protect the environmental integrity of the Waterton-Glacier International Peace Park. It added that the Waterton portion was declared a Biosphere Reserve in 1979 and the International Peace Park has been jointly nominated by Canada and the United States as a World Heritage Site. The AWA noted that the proposed well lies within the zone of co-operation for the Biosphere Reserve.

In view of the environmental sensitivity of the area and the potential detrimental impacts of the proposed well and access road, the AWA stated that an environmental impact assessment must be submitted before deciding the application. It added that the potential impacts of the proposed well cannot be adequately addressed if consideration is not given to the cumulative effects of future developments.

With regard to measures to mitigate environmental impacts of the proposed well and access road, the AWA believes that those proposed by Shell are inadequate. Specifically regarding the grizzly bear, Dr. C. Jonkel appeared on behalf of the AWA and stated there is insufficient data to determine proper mitigative steps because a regional impact assessment was not performed based on local data. He added that mitigative measures cannot be determined from extrapolated data such as that from the Flathead Valley, and that an assessment of all cumulative impacts would be required to properly determine the impact of the proposal on the grizzly bear of the South Castle Valley.

Dr. Jonkel noted that the grizzly bears are most sensitive to disturbances immediately after leaving their dens in the months of May and June, and also during late September when they are seeking and preparing their dens. He suggested that associated activity should be avoided or at least be very minimal during these periods. He further suggested that more emphasis be put on improving cover along the road and support of research efforts in adjacent areas. Additionally, Dr. Jonkel suggested a real effort be made to close adjacent areas to human use if the proposed development proceeds, for example, by improving road management, closing campgrounds, and cancelling livestock grazing permits. He said that training of employees in the area of bear awareness would be critical.

Regarding the impacts on wildlife in general, the AWA agreed that closing the road farther north than Scarpe Creek would be a significant benefit to reducing access. However, it added that the road itself would change the character of the valley and therefore the location of the gate is only one of the issues. In response to questions suggesting a shift in the time of year that the drilling operations could take place, the AWA stated that this would be very difficult because different species would be least affected at different times of the year. From a human perspective, however, the AWA agreed that shifting the period of drilling the critical zone away from the summer months would be advisable.

The AWA suggested that a fast-track environmental impact assessment in the form of a co-operative arrangement between appropriate parties could be performed. This type of assessment would be at the field level such that rare species could be identified and avoided, or in the case of vegetation, transplanted during the construction phase. Additionally, the AWA suggested that revegetation with native species and the use of fertilizers would promote rapid reclamation. It also suggested that periodic site inspection by trained personnel and monitoring of environmental indicators such as water quality could ensure that mitigative measures are successful.

Ms. E. Dunn, representing the AWA as an expert in recreational research, presented the results of a 1985 survey of users of the South Castle area. The survey indicated that the major recreational activities in the area are fishing, day-hiking, camping, and general nature appreciation, the majority of which is done on foot. Of the people surveyed, the average time period during which the people had used the South Castle area was about 12 years, and their recreational experience has deteriorated over the years due to over-use and motorized recreation. Ms. Dunn stated that 71 per cent of the users of the area indicated that the lack of industrial activity was important to them in their recreational experience.

The AWA had numerous concerns respecting emergency response planning for the proposed well, noting that the plan has not yet been finalized and was unacceptable in its present form. It requested that the plan be finalized with the appropriate agencies and be made available for review by the Board and the public prior to a decision on the application. It stated that reliance upon mechanical evacuation by helicopter or all-terrain vehicle was deficient in rough terrain, adverse weather conditions, and darkness. The AWA expressed concerns about the lack of ground access or exits from the area. It questioned the effectiveness of Shell's proposal for distribution of signs and informational pamphlets to backcountry users, stating that the wilderness user is not mentally prepared to deal with these circumstances. The AWA further questioned the adequacy of Shell's crew training in the case of medical emergency. It suggested Shell incorporate information in its emergency response plan on the specific resources available from agencies such as the trained rescue crews in both the Waterton Park and Kananaskis Provincial Park.

4.8 Timbermountain Packtrain

Timbermountain Packtrain is a family-operated commercial outfitting business which has operated in the South Castle/Waterton areas for over 30 years. It offers summer trail rides to groups in the South Castle area in proximity to the proposed well and road development. It has a base camp located at the junction of Scarpe Creek and the Castle River, close to the applicant's proposed rig camp and gate.

Timbermountain Packtrain said it had not been convinced that there is a need for this exploratory well, and noted that the drilling of the well would have an adverse effect upon its business regardless of its outcome. It did not specifically oppose the proposed road development but noted that a governing body is needed to ensure proper reclamation, and legislation is needed to ensure that public access is controlled either by sign or controlled gate. This legislation would alleviate some of its concerns regarding road access control.

Mr. Simpson said he opposed the application on the basis that the proposed well and road development would have negative effects on his trail riding operation. Encroachment of resource development into the South Castle area would have a detrimental effect on one of the few remaining natural wilderness areas of Southern Alberta. Timbermountain Packtrain noted it offers its customers a wilderness experience and that this would be affected by any commercial or industrial activities in the area. It also noted that the marketing of summer trail riding as a wilderness experience is highly competitive with other outfitting businesses in Alberta and the United States, some being closer to populated centres. It is the effectiveness of marketing that attracts possible customers, and the concept of a wilderness experience is essential to interesting these groups.

4.9 Mr. G. Hoffman

Mr. Hoffman is a registered trapper in the South Castle area and operates his trapline during the months of October through April. He is also authorized to locate a trapper's cabin in that area. The cabin is located in close proximity to the access road and the unplowed access road is used in trapping activities in the winter.

Mr. Hoffman's main concern was that the proposed plan to snow-plow the road during the winter months would increase traffic into the area and create a possible problem of vandalism to his cabin and traplines. He noted that it would be impractical to use snow machines on the plowed road and alternate routes would have to be found. Mr. Hoffman also noted that a road closure at Beaver Mines Lake would limit access to the area in which his cabin and traplines are located.

Mr. Hoffman expressed a belief that trapping opportunities around the well site would drop considerably during drilling operations and possibly for up to 2 years after drilling. He expressed further concern that some ungulates winter in this area during periods of high snowfall and the plowed road through this area could increase poaching and native subsistence hunting activities.

4.10 Pincher Creek Area Environmental Association

The Pincher Creek Area Environmental Association is a public interest group with the objectives of heightening the awareness of the public, industry, and government as to the social, environmental, and health impacts that natural gas processing and energy-related industries have and will have on the people living in the Pincher Creek area.

It was concerned with the purpose of the proposed well and questioned whether it would extend the total operating life of the Waterton Gas Plant or enable it to operate more efficiently. It also questioned the applicant's future plans for subsequent drilling operations in the South Castle area and the most likely pipeline route from the proposed Jutland location to the Waterton plant.

The Association was concerned with the dispersion of sour gases in the event of an uncontrolled flow, and questioned whether the applicant had done studies on wind, weather, and terrain to evaluate the most likely dispersion routes for sour gases. It noted that extreme conditions, if not adequately considered, could alter any studies done. These studies would be critical when considering escape routes for company personnel and the general public. The Association also discussed the effectiveness of the proposed monitoring system and questioned whether a back-up system would be available. Its final concern was related to whose responsibility it would be to rescue cattle from grazing allotments in the event of an uncontrolled flow. It questioned whether a performance bond could be offered by the applicant to provide compensation in the event of an accident.

The Association noted that the proposed well would have a long-term effect on its members and their livelihoods, and that its members are accustomed to enjoying the South Castle/Pincher Creek natural recreation areas in comparative safety.

4.11 Parks Canada

Parks Canada was concerned with the possible negative influences of the proposed well and access road on several wildlife species in the South Castle River Valley, particularly the grizzly bear and bighorn sheep. It noted that grizzly bears survive best in wild lands where man's presence is minimal. Given the evidence of poaching in this area, there is cause for concern. It also noted that very little is known about the importance of this area as bear habitat.

Parks Canada suggested that the applicant should have training objectives in bear awareness for on-site personnel. It requested the inclusion of a non-interference qualification on any drilling permit for the proposed well. That is, if a conflict developed between any personnel and bears in the area, the applicant should cease further operations until the bear or bears had vacated the area. It also requested that strict controls be established on the handling of human food supplies, garbage, and industrial wastes.

Parks Canada also noted that helicopter use could cause panic fleeing of wildlife. It said that the road closure restrictions would be the most important factor in minimizing any potential environmental impacts and endorsed the applicant's plans to reduce access with a gate.

Parks Canada was also concerned with production test flaring, specifically flaring products, concentration levels, and monitoring. It asked if test flaring could be prohibited during the high visitor period in the park.

Parks Canada noted that construction scheduling should minimize possible conflicts with wildlife and recreationalists, and indicated that the preferred construction period would be late November through to mid-April. It suggested a committee should be formed to monitor the construction of the proposed developments to ensure compliance with environmental protection specifications. It also recommended that the critical zone not be drilled between mid-June to mid-September, Waterton Park's high visitor season.

Parks Canada said the joint nomination by Canada and the United States of Waterton Lakes National Park and Glacier National Park as a World Heritage Site might be negatively influenced by the proximity of industrial activity. Those who visit Waterton are seeking an undeveloped natural area with minimum evidence of man's presence Occurrence of industrial noise or odours resulting from natural gas or industrial sources would interfere with that objective. Parks Canada noted that state-of-the-art technology must be used and offered its experience in avoiding or minimizing the negative influences of odours, noise, or the intrusive visual presence of industrial activity.

Parks Canada stated it did not endorse the applicant's Emergency Awareness Plan as presented at the hearing, but would endeavour to work with Shell to develop a suitable plan. It expressed concerns regarding procedures related to Waterton Park, and the feasibility of registering visitors to and from areas of the Park and erecting warning signs. The use of signs and the image they would create in a National Park was not favoured. It noted that the use of helicopters in the response plan would frequently be unsuitable because of weather conditions and the mountainous terrain. The only other way of advising transients would be by horseback, which is inefficient and not feasible given personnel constraints.

Parks Canada stated that the Shell evidence was unable to convince it that H_2S concentrations of 20 ppm would not occur in the Park. It requested the Board to ensure that, if the application was approved, the drilling schedule, emergency response plan, and flaring plan reflect this concern. Providing all its concerns could be addressed and if an accidental discharge does not occur, Parks Canada concluded this single well "would not have an unacceptably negative impact" on Waterton Park. It added, however, that at the present time it did not see any safeguard or guarantee for the Park, its visitors, and its natural resources.

Parks Canada expressed some concern regarding the health and safety effects of different levels of H_2S concentration, and requested guidance from the Board in this matter.

4.12 Waterton Biosphere Reserve Management Committee

The Waterton Biosphere Reserve Management Committee has as its goal to encourage the integration of use, development, and conservation of natural resources through programs of public information and education and through environmental research and monitoring. It promotes public awareness of resource management concerns facing the residents of the Waterton area. It is comprised of five ranchers and two residents of the Pincher Creek-Waterton area and two staff members of Waterton Lakes National Park.

The Committee was concerned about developments in the zone of co-operation, which comprises land adjacent to Waterton Park. It was not opposed to the application per se, but was concerned about the effects of the proposal on the environment. It believed that this single well and associated development could be put in place and drilling done "without a major environmental impact on the South Castle area", but added it has no confidence that there is a monitoring and review mechanism to ensure that this will take place. It suggested that a complete environmental impact assessment should have been done. It requested that the access road be evaluated from an environmental viewpoint to determine if relocation is advisable. It also noted that it should be the responsibility of a legal authority to control use and ban off-road motorized travel.

The Committee proposed a monitoring program be established by the applicant to monitor all resources which could be at risk; namely, water and air quality, soil chemistry, abundance and movement of ungulates and bears, and human use. It also recommended that a technical committee of various provincial and federal representatives be established to recommend mitigative measures which would be provided to the applicant.

4.13 National and Provincial Parks Association of Canada

The National and Provincial Parks Association of Canada identified itself as a voluntary national conservation group with a long-standing interest in the South Castle and Waterton Lakes area from a conservation and recreational perspective. It opposed the application and questioned the need for the well, stating that Shell has numerous other leases that could satisfy resource requirements.

The NPPAC stated that the presence of a well and access road will effectively reduce the available habitat for numerous wildlife species. The loss of habitat, the NPPAC contended, would likely be insignificant compared to increased access to the area that could result from the proposal. Specifically, the NPPAC was concerned about the effect on grizzly bear populations, stating that exploration would have a negative influence due to increased road access and associated hunting, both legal and illegal. It added that the wide ranging, low population density, and low reproduction rate nature of the bear indicates that man-caused mortality in the South Castle area would also affect population levels in the Park and adjacent lands.

The NPPAC also suggested that the proposed development would have a negative impact on habitat and recovery of wolf population. It stated that an environmental impact assessment would be necessary to evaluate impacts of the proposal in light of its significance on the ecosystem as a whole.

The NPPAC believes the proposed development would significantly reduce the attraction of the South Castle and Waterton areas for tourists and backcountry users. Although it stressed its prime recommendation was for denial of the application, it suggested a number of mitigative measures for both environmental and safety reasons. These included airlifting the rig to the proposed well site and completing an environmental study after the well is drilled to determine its impacts. It further suggested that signs be posted in all backcountry areas and brochures be distributed to all Park visitors to give information and warning to all Park visitors.

With respect to the emergency response plan, the NPPAC stated it appeared incomplete and poses a threat to the Park in a manner that is totally unacceptable.

4.14 Sierra Club, Western Canada Chapter

The Western Canada Chapter of the Sierra Club intervened as a group concerned about the enjoyment and preservation of wilderness areas. The Club took the position that the well licence should not be granted, and was generally supportive of the AWA position. It held the view that the proposed well and access road offered strong potential for increased impact on the remaining grizzly bear population. The Sierra Club suggested that long-term studies should be conducted to determine more precisely the long-term incremental environmental effects of full-scale development of the area, should it occur. Following this, it proposed a co-operative process among Shell, the public, and Government to determine the acceptability of these impacts. It was also concerned that industrial development may jeopardize the chances of the Park being designated a World Heritage Site by UNESCO.

If the well were to be approved, the Sierra Club stated that the gate on the access road should be located as close as possible to the beginning of the road and that the gate should be manned 24 hours per day to ensure restricted access to the area. In regard to the construction of the access road, it suggested that this be done in consultation with appropriate Fish and Wildlife officials to ensure minimal disturbance to the fisheries resource.

The Sierra Club stated that there were many deficiencies in Shell's emergency response plan, particularly regarding the possibility of wind coming from different directions, the possibility of the road being unusable during a blowout, and the fact that Shell had not said anything about notifying potentially affected people in British Columbia.

4.15 Sierra Club, Montana Chapter

The Montana Chapter of the Sierra Club opposed the proposed well, stating that the existence of this type of human activity is prejudicial to wildlife values, especially the non-disturbed habitat essential to grizzly bears. It also believes the proposed well would be prejudicial to the nomination of Waterton and Glacier National Parks as a World Heritage Site, and that the area of the proposed well site should be a buffer zone for the Park. The Montana Sierra Club stated that it supports all measures that will permit survival of a sustainable grizzly bear population, and that the bear requires large areas where human-bear encounters are kept to a minimum and in which human development is likewise minimized.

4.16 Mr. L. Kreck

Mr. Kreck, who presented the views of the Montana Chapter of the Sierra Club, also opposed the application on his own behalf as a private concerned citizen. He stated that the access road and consequent mechanical operation is one more downgrading disturbance influencing the survival of the already stressed grizzly bear and wolf populations. He said that the surrounding areas of world biosphere, the Waterton and Glacier National Parks, would be affected by any ambient air contamination or water degradation. He also stated that an environmental impact assessment is the best way to evaluate this proposal, adding that attempting mitigating measures never makes up for the initial and permanent damage to the prime resource.

4.17 Mr. R. Bailey

Mr. Bailey stated that his interest in the land was for recreational potential for international tourism through trail development for a variety of recreational activities. Although he did not specifically oppose the well, he was concerned that the integrity and guidelines of the Castle River Sub-Regional Integrated Resource Plan be upheld. The Plan permits natural gas exploration only under special conditions and controls to ensure preservation of the extensive recreational opportunities for the area.

Mr. Bailey admitted that some of his concerns regarding reclamation of the area were answered by Shell's evidence, but that assurance this reclamation would be successful was not given. He added a concern regarding the effectiveness of Shell's communication system in the terrain of the South Castle area in the event of a blowout.

4.18 Lethbridge Fish and Game Association/ Southern Alberta Environmental Group

The Lethbridge Fish and Game Association has approximately 1400 members in and around the Lethbridge region and is affiliated with the Alberta Fish and Game Association. The Southern Alberta Environmental Group is a relatively new organization with small membership. In a joint submission, they opposed the application on the basis that approving the well would result in no environmental or ecological benefit.

They stated that increased human activity would lead to more grizzly bear-human conflicts which would be a detriment to grizzly bear populations. The bear is running out of habitat, and the proposed access road would reduce it further. They stated that the access road would have a negative impact on sheep populations as a result of an increase in both poaching and legal hunting. A loss of critical summer elk range due to avoidance of the access road was also a concern.

With respect to the fisheries of the area, they believed there would be a negative impact due to siltation from road construction, increased fishing pressure, and potential for toxic materials associated with drilling fluids entering the watercourse.

They further considered the drilling of the well to have a serious potential for intrusion on the integrity of the Park, particularly in light of Waterton-Glacier National Parks' designation as a biosphere reserve and nomination as a World Heritage Site. It was the opinion of these two groups that an environmental impact assessment should be conducted.

They stated that many of their concerns were addressed by Shell's proposal to restrict access to the area, but they were not convinced that access could be properly controlled. They still had some reservations about details for mitigation and emergency response planning, and stated that they would oppose the application even with appropriate mitigation measures.

4.19 Mr. D. Sheppard

Mr. Sheppard appeared as a private citizen and stated that the proposed well should be rejected due to a high potential for environmental impact. He believed that development would cause a further loss of the unique natural environment and native biota in a part of the province already disrupted by industrial activity. Mr. Sheppard stated that the area contained a number of rare or unusual animals, insects, and plants, including a rare stand of Big Sagebrush. He believed the proposal would lead to increased hunting pressure as a result of easier access, and a loss of habitat for rare species such as the grizzly bear. With respect to the grizzly, he added the proposal would result in increased human contact and poaching.

Failing rejection of the proposal, Mr. Sheppard called for an adequate environmental impact assessment of the area. Failing this, he made a number of suggestions with respect to mitigative measures that could be taken to lessen environmental impact. While generally supportive of Shell's mitigative proposals, Mr. Sheppard suggested that the locked gate would be better located farther to the north near Grizzly Creek to close access to the general public. He further suggested that a botanical survey should be performed to ensure no rare species lie in the path of road construction, and the nesting sites of any rare or unique birds should be identified. More studies should be performed on grizzly bear, mountain goat, and bighorn sheep populations and movement.

Regarding the use of helicopters, Mr. Sheppard suggested that they should be avoided except in case of emergency. Mr. Sheppard was concerned that the proposed well and access road would result in a direct loss of natural environment to hikers, trail riders, and others. He believed there would be an additional loss of recreational value to users of the Waterton Park from pollution, noise, aircraft, dust, and visual impact.

Mr. Sheppard was also concerned about potential health hazards and effects in the event of a blowout. He questioned the information presented by Shell regarding the effects of various concentrations of H_2S exposure.

4.20 Mr. E. Wolf and Family

Mr. Wolf appeared on behalf of his family as recreational users of the area, and opposed the proposed well. He questioned the necessity of the proposed location, suggesting the reserves could be drained from an alternate location.

Mr. Wolf said he considers the proposal to be an invasion of scenic and sensitive areas of the mountains and foothills by industrial incursion. He said few areas of the high mountain valleys against the B.C. border have not been invaded by oil industry activity and open access roads have resulted in habitat loss and reduction in populations of many species of fish, birds, and mammals. He was concerned about a lack of restoration and reclamation of lease roads and well sites, adding that old drilling sumps can attract wildlife. Mr. Wolf also stated that, given this proposal, the Waterton Park and environs seem unlikely to qualify as a World Heritage Site.

Mr. Wolf said Shell should not have abbreviated its study of environmental impact in the area. Regarding mitigative measures, he suggested that a helicopter to transport the rig and crew has been used in other situations, and would serve to reduce construction.

Mr. Wolf questioned the setting depth of the surface casing proposed by Shell, and suggested that lost circulation could be a problem. He also had doubts about Shell's perceived low risk of a blowout and the calculations of H_2S concentrations. He was also concerned about the hazards of H_2S and sulphur dioxide (SO_2) exposure to lung tissue in the event of a blowout.

4.21 Montana Wilderness Association

The Flathead Chapter of the Montana Wilderness Association stated that it is interested in the preservation of the Northern Continental Divide Ecosystem of which Alberta wild lands are a key component. It opposed approval of the well prior to an environmental impact assessment and cumulative impact study being performed. It suggested that such an assessment would ensure that the Northern Continental Divide Ecosystem and particularly the Waterton-Glacier complex is protected from unsound development. Piecemeal development surrounding the ecosystem will endanger the unique resources of wilderness and wildlife in this area.

The Montana Wilderness Association stated that making the area more accessible would be detrimental to wildlife both through poaching and displacement in an area where other niches are not available. It further stated that the detailed drilling procedures and contingency plans stress the seriousness of the H_2S problem. Citing the Lodgepole blowout as a case of

Alberta hurting itself and its neighbours, it suggested that the effects on the Waterton Park of a Jutland blowout could be far more intense.

4.22 Other Interventions

Seven other parties filed written submissions to the Board but did not present them at the hearing. These parties have been identified in Table 1. In general, all seven parties opposed the application for environmental reasons based mainly on the potential disturbances of flora and fauna communities due to the proposed access road and associated construction.

The Glacier-Two Medicine Alliance was present for cross-examination of Shell, and expressed concerns about reclamation of the access road and the type of vegetation used for reclamation. The Alliance also raised questions about the movements of grizzly bears and wolves between the Flathead and South Castle areas.

5 VIEWS OF THE BOARD

5.1 Justification or Need for the Well

The Board has considered the evidence presented at the hearing regarding the justification or need for the proposed Jutland well. It notes that Shell has obtained the appropriate petroleum and natural gas lease and mineral surface leases for construction of the drilling site and access road. Shell has interpreted seismic data to indicate the potential presence of gas reserves and the Board heard no evidence to suggest the contrary. It notes Shell's commitment not to drill the proposed well if the Grouse well fails to encounter Paleozoic rock, as that would raise serious doubts about its seismic interpretation of the region. In the Board's view, this emphasizes Shell's contention that the well is solely for exploration purposes.

Several of the interveners suggested that there is no reason to drill the proposed well due to a surplus of gas in Alberta. Notwithstanding the current surplus, the Board recognizes that natural gas is a valuable resource and that over the long term the potential additional reserves of natural gas would represent benefits not only to Shell, but to the Alberta public interest. It therefore believes that it is important to have continued exploration for natural gas.

The Board notes the request of the AWA for an analysis of social and economic costs and benefits of the proposed well compared to the impacts of possible recreational and tourism losses. The Board believes that, given the exploratory nature of the well and the uncertainties associated with such development, the suggested analysis is not necessary.

With respect to suggestions that an alternative location for the well could be found, the Board accepts Shell's geological evidence that the downhole location is strategically located to obtain the maximum information from a single well.

Given that Shell was granted a lease to explore in the subject area and that seismic information suggests that natural gas may underlie the area in volumes worth hundreds of millions of dollars, the Board believes there is sufficient justification for the proposed Jutland well. However, that justification must not override the ability to explore for the resource in a manner which is acceptable in terms of public safety or other impacts on the public or the environment. The Board will therefore evaluate these matters in subsequent sections of the report.

5.2 Potential Impact on the Environment and Mitigative Measures

This and the following sections of the report deal only with impacts resulting from normal operations. The impacts of a possible blowout are dealt with in Section 5.7. The impact on the environment of the possible drilling of the well at the proposed site relates to construction of the drilling and drilling waste disposal sites and access road, subsequent drilling of the well, the end use of the road, and all activity associated with those tasks.

The term "environment" as used in this report, refers to wildlife as well as vegetation, soil, and water. The impact on the environment will be reviewed over the proposed 1-year construction and drilling phase as well as some reasonable time into the future. Since the well would be exploratory in nature, two possible future scenarios must be perceived in order to adequately deal with mitigative measures. The well would be either successful and left suspended for a certain period of time or the well would be abandoned.

5.2.1 Wildlife

At the hearing, the primary focus on wildlife was with respect to the grizzly bear, although other wildlife species were identified and did receive considerable attention. Concerns for all wildlife fell into three categories:

- loss of habitat leading to possible mortality,
- interruption of normal movements to or from the proposed construction and drilling areas, and
- increased mortality due to greater human access to the area.

Insofar as loss of habitat is concerned, the Board recognizes that the existence of levelled drilling and waste disposal sites, the camp, and the improved road would reduce the range available for wildlife. The Board believes, however, that the reduction would be relatively minor, particularly having in mind the present existence of a large, partially-cleared area and the limited access road, and the fact that the proposal relates only to a drilling operation for a single well. Similarly, the Board does not expect that the disruption of normal movements by wildlife through the area resulting from the drilling of this one well would have a substantial negative impact on the various species.

Both of these impacts, on habitat and movements, would be reduced by Shell's undertakings to prohibit workers' vehicles in the area, use whistles on vehicles that must be there, fence the waste disposal site, bridge the Castle River to avoid siltation problems, and minimize helicopter flights over the area. The Board accepts these undertakings and, if the proposed well is approved and drilled, would urge Shell to do everything practical to minimize the extent of traffic and the level of noise that would be associated with the operation.

Turning to the question of potential impacts on wildlife as a result of increased access to the area, the Board agrees with most participants in the hearing that this would represent the major threat to wildlife from the proposal. The Board notes that Shell would take the following mitigative steps if its application were approved:

- A locked gate would be installed at the Scarpe Creek junction and manned during the drilling activities.
- Firearms and use of motorized recreational vehicles by staff would be prohibited.
- Combustible garbage would be incinerated at the campsite and non-combustibles would be transported out of the area.
- Grizzly bears in the immediate vicinity of the camp or operations would be removed, if necessary, and not be killed.

The Board is satisfied that the latter three items mentioned above would very effectively reduce the possibility of increased mortality of wildlife, particularly grizzly bears, as a "direct" result of activities by Shell or its employees. In this regard, the Board believes the suggestion by Parks Canada to give bear-awareness training sessions to Shell staff is worthwhile, and should be seriously considered by Shell to further minimize the possibility of direct impacts on wildlife mortality.

In the Board's view, the "indirect" threat to wildlife mortality from Shell's proposal is of greater concern. This could result from increased hunting and poaching and other possible kills by persons who are not Shell employees that will have improved access to the area. The Board notes Shell's admission that lack of proper access control could result in significant long-term impact on the grizzly bear population. It also notes the belief of Diamond Hitch Outfitters and some other interveners that road closure anywhere along the South Castle River Valley would not improve the situation for the grizzly or other wildlife. In the Board's view, the gate closure at the Scarpe Creek junction would help to minimize the threat to wildlife mortality south of this point, but would do little to minimize impacts north of the junction.

The Board sees a paradox with respect to this matter. If the well proceeds, Shell would very likely be able to control any direct mortalities. However, Shell is very limited in what it can do to control the indirect mortalities that could result from the improved access it would, of necessity, provide to the area. These indirect mortalities could occur because others, many of whom would be members of the Alberta public, would either exercise legal rights to hunt or break the law by poaching. To some extent, a denial of the Shell application due to these potential impacts would be to penalize Shell and the broad Alberta public, who could benefit from increased resource exploration, for something over which Shell has little control. The Board believes the better approach would be to restrict the likelihood of excess mortalities to wildlife through appropriate hunting and fishing restrictions and increased surveillance.

The Board notes that, contrary to Diamond Hitch Outfitters and some other interveners, a number of interveners including the AWA suggested a gate closure farther to the north would improve the situation for wildlife. Additionally, some interveners believed that for any road closure to be effective, some form of legislation would be required and would need to be rigidly enforced. The Board does not consider itself to have the jurisdiction to direct a closure farther to the north, and indeed, because the hearing was not advertised to consider such a possibility, questions whether it has heard from all of the groups that might be impacted by such a step. For this reason, the Board is not recommending any action in this respect but will make the appropriate government department aware of the comments made at the hearing. If the well is approved and proceeds, the Board suggests that Shell further discuss the question of the location of a gate closure with government officials.

The Board also notes that the possibility of airlifting the rig and associated equipment to the well site by helicopter to remove access concerns was raised at the hearing. The Board believes that such an operation would be impractical. It also notes the view expressed by Parks Canada that "...it would be a much greater disturbance even if it was physically possible to fly a rig in like that...than the road access would cause.".

There was some discussion at the hearing of possible impacts on wildlife which could result from limited production testing of the proposed well. The duration of such testing would be very limited and would be subject to a host of regulations and approvals of the details by the Board. The Board is satisfied that if the well were approved and proceeded, any testing that would be necessary could be conducted in such a manner as to have virtually no long-term impact on wildlife.

After the proposed 1-year construction and drilling phases, the impact on wildlife would depend on whether the well was successful and left suspended for a certain period or whether it was abandoned. In either case, the Board believes that Shell's proposal for reclamation of the well site, the drilling waste disposal site, and drilling campsite would adequately reduce the impact on wildlife with respect to loss of habitat or disrupted movements. The two scenarios, however, warrant comment with respect to impact on wildlife due to improved access.

If the well proceeds and is abandoned, Shell indicated that the road south of Scarpe Creek would be returned to its original state. Measures to reduce access would include transplanting large trees at the entrance to Scarpe Creek. Shell also stated that maintenance such as grading and snow-plowing would be discontinued from the access closure at Scarpe Creek to the junction of Highway 774. These two features would, in the Board's view, go a long way to restoring the area to its current state.

In the case where the well was left suspended for a certain period of time, Shell indicated that the road would remain gated and locked at the Scarpe Creek entrance. Also, additional mechanical barriers would be installed at the gate and along the road and consideration would be given to placement of large boulders at strategic points. Maintenance of the road surface from Scarpe Creek to the junction of Highway 774 would cease when Shell is not active in the area. If the well were suspended, the temporary bridge would also be removed.

As indicated previously, this Board does not consider itself to have jurisdiction over road closure or maintenance. However, the subject of access to the area if the well proceeds, is successful, and is suspended, was a major concern at the hearing. The Board is of the view that if this scenario unfolds, it would not be appropriate to snow-plow the road from Scarpe Creek to the junction of Highway 774 during the winter months. Any monitoring of the well during winter could be done by other modes of transportation. With such an approach, during any period of well suspension, winter access to the area would be little different than is now the case.

In summary, with respect to possible impacts on wildlife of the Shell proposal to drill the Jutland well, the Board recognizes that impacts would occur but does not believe that they are so serious as to cause denial of the application. The most significant threat to wildlife would result from potential increased mortalities due to improved public access to the area. With stringent control by Shell of its activities and those of its employees, and appropriate actions by government officials to limit access and control poaching and other illegal activities, the Board believes the problem of increased mortality of wildlife would not be serious.

5.2.2 Vegetation, Soil, and Water Quality

The Board recognizes that construction of the drilling and waste disposal sites has potential for impact on vegetation and soil, especially since these activities require a certain amount of levelling and removal of topsoil and existing vegetation. Of particular concern at the hearing was the Big Sagebrush community that exists between the road and the river on the southwest slopes of Whistler Mountain. Some questions were also raised on the type of revegetation to be used during reclamation.

The Board is generally satisfied that the method of construction proposed by Shell would minimize any permanent impact on the environment. The Board recognizes suggestions of the Waterton Biosphere Reserve Management Committee and other interveners that a technical committee be established for evaluating the appropriateness of the road location, monitoring construction activities, and recommending mitigative measures. The Board acknowledges that this type of committee might be useful for major developments but believes this approach is not warranted for a single exploratory well. A more practical approach to minimizing impacts related to construction activities would be through on-site inspections and consultation by appropriate government officials as construction progresses. This was suggested by a number of participants at the hearing and in the Board's view, would be particularly beneficial for identifying rare plant and animal species in the path of construction, and also to minimize siltation effects on fish-bearing habitat. If the Board approves the application, it would have discussions with the appropriate government departments to consider the need for special government inspections and increased attendance during construction.

Once drilling commences, any improper waste management of drilling fluids, sewage, or garbage could have impact on the environment. The Board is satisfied that the proposed measures dealing with these concerns have been adequately addressed by Shell. Also, the Board has in place very stringent regulations on waste management and would ensure that Board staff regularly inspect the facility to ensure that those requirements are met.

5.3 Potential Impacts on Commercial Users

The Board has given careful consideration to the potential impacts of the proposed well and access road on the two commercial outfitters in the South Castle Valley. The outfitters expressed concerns regarding potential impacts due to improved access into the area and more frequent contacts with members of the public. The Board recognizes these and believes that an effective road closure at Scarpe Creek could help to mitigate the problem.

The Board is aware that a portion of the riding trail presently used by the outfitters would become access road and that public and rig traffic could detract from trail riding operations. The potential impact would be reduced by Shell's undertaking to minimize both ground and helicopter traffic between the camp and well site. It should also be noted that some motorized recreational traffic already frequents the area.

The Board has also considered the concerns of Mr. Judd regarding potential impingement on his base camp, and Mr. Simpson's concerns regarding the proximity of Shell's proposed campsite to his base camp at Scarpe Creek. It notes the outfitters' evidence that they hold miscellaneous surface leases for their base camps, and Shell's evidence that it holds a similar lease for the southerly portion of the proposed access road. Although the Board considers itself to have jurisdiction to assess the potential impacts of Shell's proposed campsite on the outfitters' base camps, it does not believe it has jurisdiction to direct that the location of Shell's proposed access road or campsite be changed. In assessing those potential impacts, the Board, having heard no detailed evidence regarding this matter, is not satisfied that they are such as to warrant denial of the application. Rather, the Board suggests that, if the application is approved, consultation among the outfitters, Shell, and the appropriate government department could result in arrangements to mitigate negative impacts.

Both outfitters contended that the presence of Shell's proposed drilling operations would detract from the wilderness experiences they market. In that regard, the Board notes Mr. Judd's evidence that the drilling rig would be visible from only a few trail locations within 1 to 5 km distance, and that visual contact would be of short duration.

In terms of impact on the outfitters beyond the drilling stage, Mr. Judd indicated there would be virtually no impact if the well were abandoned. The Board agrees this would be the case, and indeed, it does not believe that there would be a substantial negative impact on the outfitters because of the existence of a suspended well in the area. This conclusion assumes that Shell would properly carry out the reclamation and measures to restrict access which are described in an earlier section of the report.

Regarding the trapping operations of Mr. Hoffman, the Board notes Shell's commitment to meet and resolve his concerns regarding winter access to the area. With respect to Mr. Hoffman's comments that road closure at the Beaver Mines junction would help to limit access in the area of his cabin and traplines, the Board believes that this could indeed reduce the potential for vandalism. However, as previously stated, the Board does not consider itself to have the jurisdiction to direct such a road closure, but would make the appropriate government department aware of the comments made at the hearing should the application be approved.

The Board recognizes that there is potential for alteration of animal movement patterns such that Mr. Hoffman may experience a reduction in trapping harvest of some furbearers in areas near the campsite, well site, or access road. In that regard the Board understands that Trapper's Compensation could be available to offset the impact of Shell's operations on Mr. Hoffman's trapping activities.

In summary with respect to commercial users of the area, the Board recognizes that there would be some impacts on their operations primarily limited to the period of construction and drilling of the proposed well. The Board has no evidence before it as to the magnitude of the potential impacts measured in monetary terms. In its judgement, this magnitude would not outweigh the potential value to society of the exploratory well proposed by Shell. Moreover, the Board notes that the commercial trail riding permits held by the outfitters and the trapping certificate held by Mr. Hoffman do not give them a right to exclusive possession of the areas described in their permits. It further notes that the Government's zoning of the area allows for natural gas exploration under special conditions and controls. Given these considerations, the Board would not see potential impacts on these parties as justification for denial of the Shell application. Nevertheless, the Board believes every reasonable effort should be made by Shell to minimize any impacts that would result. If a well licence is granted, the Board would ask Shell to have on-going discussions with commercial users of the area towards this objective.

5.4 Potential Impacts on Recreational Users

The Board is well aware of the recreational potential of the South Castle area as identified by both the

Integrated Resources Plan and many of the interveners. It is also aware that the Plan allows natural gas exploration under special conditions. Its consideration of the potential impacts on recreational users must take into account both of these facts.

The Board recognizes that for those people who currently visit the area, the existence of an upgraded road, camp and drill sites, and the drilling operations would have an impact by detracting from the "wilderness experience". In the Board's judgement, these will not be overwhelming impacts in that there will be many parts of the general area where the disturbances will be neither seen nor heard. Also, the disturbances resulting from drilling operations would be only for about 1 year, after which removal of the rig and camp and reclamation activities would reduce impacts to negligible levels.

The improved access to the area also has potential for impacts on recreational users. On the one hand, the increased traffic could detract from the area for those who now frequent it and wish essentially total solitude. On the other hand, the improved road has the potential for encouraging more people to use the area. If there was an expectation of greatly increased numbers in the area, these opposing impacts would probably equate to an overall negative impact.

However, with the planned activities towards minimizing public access, such as the closure at Scarpe Creek and the prohibition of Shell workers having vehicles at the campsite, the Board does not see the area being overrun with visitors. Consequently it does not see this potential impact as a serious problem.

Regarding the potential impact of the proposal on the recreational value of Waterton Lakes National Park, the Board believes this to be minimal. It recognizes evidence of Shell that the proposed well site is behind Sage Mountain such that it would not be visible from the Park. The Board also considers the approximate 5-km separation between the well site and the Park boundary to be more than adequate to negate concerns regarding noise and normal odour problems.

With respect to concerns of interveners suggesting the proposed well prejudices the Park's nomination as a World Heritage Site, the Board is aware that numerous sour gas wells already exist closer to the Park boundary. Additionally, according to the Integrated Resource Plan, access restrictions associated with natural gas development in the General Recreation Zone are designed to provide a buffer to the integrity of the Park. The Board also notes that both Parks Canada and the Waterton Biosphere Reserve Management Committee considered the impact of the proposed well on the Park could be held to acceptable levels if adequate precautions could be ensured.

The question of possible impacts on the Park of a blowout are discussed in Section 5.7 of the report.

All things considered, the Board does not believe the drilling of the single exploratory well as proposed by Shell or the related construction activities would have serious and irreversible impacts on casual recreational users of the area. It therefore would not deny the application because of these concerns.

5.5 Precautions to Prevent a Blowout

The chances of a blowout in any drilling well are very small. However, since the proposed well would be a critical sour well, the Board would require extra precautions to prevent a blowout. These would relate to the personnel, equipment, and procedures used in drilling the well.

The Board reviewed Shell's proposed casing design and considers the design and setting depth of the surface casing to be adequate. Regarding the intermediate casing string, the Board considers the design to be appropriate both in terms of its design for tension, collapse, and burst criteria and also with respect to sour service design criteria. The Board agrees that Shell's proposal to set the intermediate casing at 4400 m, although in excess of the Board's normal 3600-m requirements, would be appropriate given Shell's geological prognosis. However, the Board would expect that, should the well be drilled, the casing setting depth would be determined in light of actual occurrence of formation tops.

The Board notes the concerns of Diamond Hitch Outfitters regarding the intermediate casing design and its adequacy for use as a production string. Shell proposes to determine the integrity of the intermediate casing by caliper logging or pressure testing prior to deciding on running a liner or full-length casing for production purposes. The Board is satisfied with Shell's plan to run these tests, and notes that the results of these tests would be required as a part of a separate application to the Board for production casing design.

The Board reviewed Shell's intention of drilling the proposed well with a drill string comprised of new X-95 and Class II G-105 drill pipe. It considers the components appropriate for use given the depth of the well and the potential H_2S concentration. It further believes that Shell's proposal for hardness testing and other inspection procedures are necessary to ensure safe drilling operations.

The Board notes that the pressure rating of the BOP stack conforms to Board regulations, and considers it adequate for drilling the proposed well. It believes that Shell must, as proposed, ensure that all components of the BOP system are tested to ensure the adequacy for sour service. It further believes that the shear blind rams proposed must be tested on the X-95 pipe to be used.

The Board acknowledges Shell's proposal not to pretreat the drilling mud with H_2S scavengers, but rather to rely on the pH of the drilling fluid as the prime indicator of H_2S in the mud system. Given Shell's intent of installing continuous pH monitoring equipment, the Board is satisfied that pretreatment of the mud is not necessary. However, the Board would require, as proposed by Shell, that an adequate supply of H_2S scavenging material be stockpiled on location.

In reviewing the kick detection system proposed, the Board believes that the degree of monitoring is inadequate for an exploratory critical sour well. It has considered the need for continuous electronic monitoring of drilling and drilling fluid parameters to enable personnel to recognize potential problems at the earliest opportunity. Given the critical nature of this well, the Board believes this type of additional monitoring is warranted. If the well is licensed, the Board would therefore require the use of continuous electronic monitoring of the more significant drilling and drilling fluid parameters during the drilling of the critical zone.

The Board is generally satisfied with Shell's proposed mud mixing and conditioning equipment. It is also satisfied that an active* mud system at surface equal to 100 per cent of the hole volume would be adequate. It recognizes that, given an adequate water supply available at the well site for immediate addition to the system, this volume, plus the approximately 30 per cent excess in the standby system, would be adequate for controlling most lost circulation situations. The Board understands that Shell proposes to drill a water well at the well site for its water requirements while drilling. The Board would require that, prior to commencement of drilling, Shell satisfy it that there is a water supply capable of providing sufficient water volumes to be used in potential lost circulation situations.

The Board believes that one of the most effective precautions to avoid a blowout is the use of careful drilling procedures. In this regard, the Board is satisfied with the proposed qualifications of Shell's Drilling Foreman and its intention to conduct regular BOP drills and equipment checks. The Board stresses the importance of these inspections to ensure that personnel are qualified to handle well control situations and that equipment is fully operable, and believes that ERCB staff could assist in this regard. As a result of the Lodgepole Phase 2 report, Board staff conduct a minimum of three inspections on all critical wells during which the staff ensures that all drilling equipment is functioning properly and that proper drilling and kick-control procedures are being followed. If a well licence is issued, the Board would ask its field staff to be present when the intermediate casing is drilled out and to conduct at least three comprehensive inspections during the estimated 83-day period in which the critical zone would be open.

The Board, if it licenses the well, would require that Shell, while in the critical zone, report weekly by telephone to an ERCB area office, or more frequently if requested to do so, to report any problems encountered, confirm the performance of daily inspections, facilitate effective scheduling of ERCB inspections, and identify upcoming operations. The Board would also require Shell to notify the ERCB area office immediately by the quickest effective means of any unusual drilling problems such as lost circulation, a kick, or the persistent presence of sour gas in the drilling mud. Given the potential H_2S release rate from this well, the Board believes this increased involvement of its staff would be warranted.

In summary regarding the precautions to be taken to prevent a blowout, the Board is satisfied that those proposed by Shell, subject to the modifications mentioned earlier, are fully adequate for the proposed well. Those precautions, coupled with Shell's record as a capable, careful operator, very experienced with sour gas, satisfy the Board that the proposed well could be drilled with only a very small chance of a blowout occurring. Notwithstanding this, the Board recognizes that one can never be absolutely certain a blowout would not occur, and accordingly, it will review the actions that would be taken and the possible impacts of a blowout in the following sections of the report.

5.6 Actions in the Event of a Blowout

Actions planned in the event of a blowout would be documented in Shell's emergency response plan. The Board's draft Interim Directive ID 84- defines a critical well and lists as a requirement that a satisfactory emergency response plan must be filed with the Board prior to spudding the well. The Board, in this section, will review Shell's emergency response planning as set out in the application and at the hearing, giving consideration to the concerns expressed by interveners.

The Board notes that many of the interveners, particularly the AWA, questioned the effectiveness of Shell's transient awareness program and its ability to conduct a consistent and adequate program of H_2S

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* The Board considers the volume of the active system to be the volume of mud ordinarily capable of being circulated and therefore excludes those tank volumes rendered inactive due to the location of inlet and outlet piping in the mud tanks.

monitoring in the valley in the event of a sour gas release. It further notes concerns regarding the ability to ensure complete evacuation of Shell's proposed emergency planning zone in all weather and light conditions. The Board also recognizes the concerns of Parks Canada regarding Shell's proposed registration program and the drilling of the critical zone during a period of peak Park use.

The Board agrees with many of the interveners that it would be virtually impossible for Shell to be aware of all people who may, at any one time, be within the emergency planning zone. The Board further believes that Shell could experience severe difficulty in evacuation procedures, particularly at night and during bad weather, even if it were possible to know the exact location of all transients. For these reasons the Board would, if it licensed the well, require more stringent ignition criteria than those proposed by Shell. Ignition would convert the released H_2S to SO_2 and, due to the heat of the fire and resulting thermal rise, disperse it over a much greater area. This would also remove the need for training in specialized evacuation procedures as suggested by the AWA.

An evacuation and ignition policy for sour wells has been under consideration by the Board for some time. A draft policy is now being circulated to industry, government agencies, and public interest groups for comments and suggestions. The policy is designed to protect the health and safety of people near sour gas operations. If a proposed well has a high potential for H_2S release and is located in an area that makes evacuation impractical, the draft policy requires immediate ignition of a release of sour gas. Having regard for the location of the proposed Jutland well, the Board would make any licence granted subject to the condition that, in the event of a complete loss of control of the well and a release of sour gas, it be ignited.

If there were only a leak or partial loss of control such that the presence of H_2S was generally confined to the immediate vicinity of the lease, the condition of the licence would allow for the well not to be immediately ignited, but only with the approval of the Board. The Board would not give its approval unless it was satisfied that there was a high likelihood that control could be regained in a short period of time and that there was no threat to the health and well-being of the public.

Shell also indicated that in the event of any indication of a potential blowout, its planning would provide for early contact and continued communication with the commercial outfitters and officials of Waterton Park, the Town of Pincher Creek, and all involved government departments. Shell would quickly marshall the necessary resources to bring about control of the well and ensure safety of the public in the meantime.

The Board is satisfied, subject to the more stringent ignition requirement described earlier, that Shell's planned reaction to a blowout would be generally satisfactory. Further details would be evaluated when the emergency response plan has been finalized. In this regard, the Board would require that Shell provide an opportunity for input to the plan from all parties that could be involved, including government officials, public representatives, and public interest groups such as the AWA, before the plan is submitted to the Board in final form.

5.7 Potential Impacts of a Blowout

There was considerable discussion at the hearing regarding the H_2S release rate as estimated by Shell and its appropriateness for emergency planning purposes. The Board acknowledges the uncertainties in these matters due to the exploratory nature of the well. It considers Shell's estimate of 13.3 m^3/s to be reasonable given these uncertainties; however, the immediate ignition criteria as described in the previous section remove the necessity for detailed consideration of the potential H_2S release rate. The impacts of a blowout will be evaluated on the basis of the immediate ignition requirement.

The impact from a sour well blowout can be divided into impact on human health and safety and impact on the environment such as wildlife, vegetation, soil, and water. The most significant impact relates to the release and subsequent dispersion of gas containing H_2S or SO_2. Of course, the longer the duration of the well blowout, the more prolonged and potentially serious the impact.

The Board notes that a number of interveners raised concerns regarding the anticipated health effects of H_2S and SO_2 at various concentrations. The Board generally relies on public health and safety organizations for information on these matters. Studies are on-going and a variety of guidelines exist. Given the numerous requests for information made during the hearing, the Board is publishing, as Appendix 1 to this decision report, a table entitled "Characteristics and Health Effects of H_2S and SO_2". The appendix was compiled from those government documents cited therein.

Given the previously-described ignition criteria, if a total blowout occurred, the well would be immediately ignited. If it was not, this would be because the leak was small in nature. In either case, the volume of H_2S released to the atmosphere would be small and would therefore impact only on a very limited area. Recognizing that blowouts are invariably preceded by some degree of problems at the well, the Board would require that Shell's emergency response plan include the search and evacuation of the immediate vicinity of the well at the outset of a problem. The region which could be threatened by the small H_2S release would be so limited that it would probably not be much larger than the presently cleared area in which the well would be located. Therefore the evacuation of this area would not represent a serious problem in that any member of the public would likely be visible from the rig and in any case would be easily sought out. Additionally and as proposed by Shell, the commercial outfitters in the area would have radios and if they happened to be in the vicinity would be contacted and alerted at the first sign of a problem. The Board therefore concludes that the H_2S which could be released, recognizing the ignition criteria, would not be a serious threat to public safety.

In the Board's view, the ignition criteria also remove concerns expressed regarding the potential impacts of H_2S on cattle in nearby grazing allotments.

Insofar as the possible impact on wildlife of an initial brief release of H_2S is concerned, the fact that only the immediate vicinity of the well would be affected, which wildlife tends to avoid in any case, would most likely avoid any mortalities. There could be a limited stress from the initial small volume of H_2S on plant life, but again because of the short duration of the release, the Board does not believe that significant permanent damage would occur.

Having dealt with the possible impact of H_2S if a blowout occurred, it is also necessary to assess the possible impacts of SO_2. This would be of less significance because the SO_2 which would result from the firing of the well would disperse over a greater area and concentrations at the ground surface would be relatively low. Some understanding of the potential impact resulting from a large release of SO_2 can be gained from the Lodgepole blowout. In that instance, very large volumes of SO_2, some 900 tonnes per day, were emitted over two separate periods, totalling 41 days, when the well was on fire. The maximum peak SO_2 reading on the basis of monitoring data taken during the periods was 0.275 ppm which occurred about 50 km from the well. This compares to a nuisance ground-level concentration standard of 0.17 ppm over a 1-hour interval and to a life threatening level of 1000 to 2000 ppm for continued exposure.

With this understanding of the dispersion behaviour of SO_2 as a background, the evidence of Dr. Leahey respecting its dispersion in the specific case being dealt with satisfies the Board that SO_2 released from the proposed well would not represent a threat to human safety in that ground-level concentrations would be very low. For the same reason, cattle would not be threatened nor would there be a significant amount of irreversible damage to the environment.

In the event of a blowout, whether ignited or not, there would be impacts in the immediate vicinity of the well due to activities to control the well. The Board believes these problems would be short-lived and reparable.

The Board recognizes that a well blowout and its ignition, even though the chances of one occurring would be small, would have a nuisance impact in that occasional SO_2 odours could occur at different times and at different locations over a large area. In this regard, the Board agrees with the position of Parks Canada that such a situation would be highly undesirable in Waterton Park during the peak tourist season. The Board is also aware that the peak tourist season is the time of year when the South Castle area itself is likely to have the greatest number of visitors. The nuisance impact of a well on fire and emitting SO_2, and of well control efforts, would thus be least desirable at this peak season.

For these reasons, the Board has reviewed the proposed drilling schedule that Shell put forward at the hearing. It notes that, if the well were approved, Shell would await the results of drilling at the Grouse well. If they were positive in nature, drilling at Jutland would commence in about November of 1986. The expected time of drilling of the critical zone would thus be June, July, and August of 1987. As indicated previously, these would be the least desirable months in the unlikely event that a problem were to occur. Accordingly the Board, if it issues a licence, would require that Shell schedule its operations so that it would not commence drilling in the critical zone prior to mid-September of 1987. This would mean that any problem situation which might occur would be after the peak tourist period in the region and the Park. An additional benefit would be that, in the case of an ignited blowout, the potential SO_2 effects on vegetation would be minimal since the growing season would be essentially past.

The Board has also given considerable thought to the concerns expressed by Parks Canada regarding the awareness program proposed by Shell. Parks Canada suggested that the distribution of brochures and posting of signs would create an uneasy feeling with visitors to the Park and questioned whether the benefits would be worth the negative impacts. The Board understands this concern, particularly having in mind the immediate ignition requirement which would remove any need to consider evacuations from the Park, and the further requirement which would move the drilling of the critical zone out of the peak tourist period. If the well is approved, the Board would ask Shell to have further discussions with Parks Canada and to follow whatever preference Parks Canada had in terms of an awareness program within the Park. Shell's proposed awareness program within the South Castle Valley would be appropriate, in the Board's view, because it is immediate to the proposed well site.

In summarizing its views respecting the possible impacts of a blowout, the Board first emphasizes that the most important objective must be to avoid a blowout. The Board is satisfied that Shell's plans would minimize the possibility of one occurring, but if it did occur, the immediate ignition criteria would be critical in terms of safeguarding public safety and minimizing environmental impacts. With such a requirement in place, the Board concludes that the impacts of a blowout, although potentially very significant, would not be disastrous.

6 FINDINGS OF THE BOARD

Having considered the evidence presented at the hearing, the Board finds as follows:

1. The lands for which the well and access road are proposed have been designated by the Castle River Integrated Resource Plan as General Recreation. This designation allows for petroleum and natural gas exploration subject to special controls and conditions, such as restricted access.
2. Shell has the right to explore the area by way of petroleum and natural gas leases, and the necessary surface leases for access road and well site construction.
3. Given the exploratory nature of the well and based on available seismic and geological interpretations, and recognizing the long-term benefits to Alberta of resource development, there is sufficient justification for drilling the proposed Jutland well, provided any risk to public safety and impacts on the environment are held to acceptable minimums.
4. The drilling of the Grouse well in British Columbia will provide a test of Shell's seismic interpretation, and the proposed Jutland well would not be drilled if the Grouse well fails to encounter a build-up of Paleozoic rocks.
5. Seasonal access to the South Castle area is presently possible to Scarpe Creek by conventional motor vehicle, and up to and beyond the proposed well site by four-wheel drive or all-terrain vehicle. Winter access to the South Castle Valley is prevented only by the accumulation of snow.
6. The proposed well site and drilling waste disposal site are located in areas previously disturbed and cleared by salvage logging. The proposed access road would follow existing access roads or trails. Construction activities would therefore result in minimal additional disturbance to the environment, and would minimize habitat loss and avoidance responses of wildlife.
7. The impacts of construction activities on the environment could be further minimized through on-site inspections and consultation with appropriate government agencies as construction activities progress. This would be particularly beneficial for identifying rare plant and animal species in the path of construction, and also to minimize siltation effects on fish-bearing habitat.
8. Shell's proposals for mitigating environmental impacts, such as minimizing road and helicopter travel, initially a portable bridge over the Castle River, prohibiting firearms and restricting leisure activities of personnel, and careful handling of waste and garbage, are well thought out and should be effective. Consideration should be given to training Shell personnel in bear awareness in an effort to reduce the potential for man-bear confrontations.
9. The major impacts on wildlife, and particularly the grizzly bear, would be the threat of increased mortality due to increased road access. Road closure by way of the locked and manned gate at Scarpe Creek would restrict access beyond this point during the drilling period. If the well proceeds, Shell and government officials should consider whether a closure farther to the north would be appropriate.
10. The threat of increased mortality to wildlife which would result from improved access to the area north of Scarpe Creek could possibly be reduced by appropriate hunting and fishing controls and increased surveillance and penalties for poaching.
11. If the well proceeded and was successful, any testing would be very limited in nature and should not have a significant long-term impact on wildlife or on the environment.
12. If the well proceeded and was abandoned, Shell's reclamation plans are such that no lasting impact on the environment would be likely. The closing off and reclamation of the access road south of Scarpe Creek and the cessation of maintenance on the road north of that point, would reduce the access to the area to much the same as exists today.
13. If the well proceeded and was suspended, Shell's reclamation plans to prevent access south of Scarpe Creek would be reasonably effective. In such circumstances, the road north of Scarpe Creek should probably not be maintained and there should be no snow removal in winter.

14. Shell's proposed drilling and construction activities, while in keeping with the integrated resource plan, may detract from the operations of the commercial outfitters. Shell's proposed mitigation and reclamation proposals will reduce potential impacts such that this one exploratory well should not have major negative impacts on the outfitters' activities. Potential impacts can be further minimized by close contact between Shell and the outfitters.

15. If the well proceeds, discussions with government officials should be sought in an effort to alleviate concerns of the outfitters regarding conflicts in base camp locations and impingement upon the base camps by the general public.

16. Winter road closure by way of a locked gate at the Beaver Mines junction would help to alleviate Mr. Hoffman's concerns regarding potential vandalism to his trapper cabin. This possibility should be considered by the appropriate government department.

17. Trapping activities could be affected to some degree during winter drilling operations both in terms of road travel and activities near the campsite and well site. If this is the case, Trapper's Compensation may be available.

18. There would be some short-term impacts on recreational users of the South Castle area resulting from the planned access road and the existence for 1 year of the camp and drill sites. Also the improved access would allow for more visitors to the area, which some users would see as a negative impact.

19. The well site and access road are of sufficient distance from the Waterton Park boundary that the proposal would not result in visual or other negative impacts on recreational users in the Park.

20. The casing design program proposed for the drilling of the well is adequate. Casing integrity tests as proposed by Shell would be required prior to approval of a final production casing program.

21. The drill string design consisting of X-95 and G-105 drill pipe is satisfactory given the well depth and potential H_2S exposure. A comprehensive testing program for eliminating excessively hard joints, as proposed by Shell, would be very important.

22. The proposed BOP stack design is generally satisfactory subject to reviewing all components to ensure adequacy for sour service and testing of the shear blind rams on the grade of drill pipe to be used.

23. Shell's proposal not to pretreat the drilling mud with an H_2S scavenger is satisfactory subject to Shell stockpiling an adequate supply of scavenging material at the drilling site for immediate addition to the mud system if necessary.

24. The exploratory nature of the well indicates that caution is required regarding formation pressures, flow rates and fluid compositions to be encountered. Therefore a need exists for Shell to conduct continuous electronic monitoring of key drilling and drilling fluid parameters to ensure that potential drilling problems are recognized at the earliest possible opportunity.

25. The mud system is essential in maintaining a suitable hydrostatic overbalance or controlling lost circulation problems. Shell's proposed equipment and excess capacity in its active surface volume are generally satisfactory. However, to be most effective an adequate water supply must be available prior to commencement of drilling.

26. Careful drilling procedures are vitally important to ensure against a blowout situation. The proposed qualifications of Shell's drilling personnel, and its intentions regarding BOP drills and equipment checks, are generally satisfactory. The Board field staff should play an active role in this regard because of the critical nature of the well.

27. Since the proposed well is located in a region frequented by backpackers and other recreational users, there is no way of knowing with certainty whether people would be in the area. Also, in periods of bad weather contacting such people could be extremely difficult. Accordingly, if a total blowout occurred at the well, it would have to be ignited as soon as the workers could be evacuated from the rig and it would be safe to do so.

28. If a leak or partial loss of control occurred at the well, it should be ignited unless it is clear that control of the well is imminent and there is no threat to public safety.

29. The emergency planning zone proposed by Shell is conservative particularly having in mind the ignition criteria that would apply if the well were licensed.

30. Shell has the experience and resources to deal with potential control problems at a sour well and its plan for doing so is generally satisfactory.

31. With the immediate ignition requirement, only small volumes of H_2S would be released if a blowout occurred. This would not represent a serious threat to public safety or the environment.

32. The SO_2 which would be released in the case of an ignited blowout would disperse such that no significant impacts could be expected on human health or the environment.

33. If a blowout occurred and was ignited, although the SO_2 would not be a threat to public safety, there could be occasional odours at different locations at significant distances from the well. These could create some limited discomfort and would represent a nuisance.

34. If the application was approved and drilling proceeded in accordance with Shell's schedule, operations would be in the critical zone during June, July, and August when the tourist season in Waterton Park and the number of visitors to the South Castle Valley are at a peak. This would be undesirable given the possibility, however remote, of a blowout and the nuisance impact of SO_2. Drilling of the critical zone therefore should be delayed beyond this period.

7 DECISION

On the basis of the findings summarized in the preceding section of the report, the Board concludes that the proposal to drill the exploratory well, SHELL JUTLAND 14-3-3-2, has the potential for significant benefits to the Alberta public interest and could be drilled with minimal impacts on the environment and little threat to public safety or well-being. To accomplish the latter would require careful adherence by Shell to the construction, drilling, and emergency response plans described in the application and the many undertakings given at the hearing. Close surveillance of the operations by the Board and the appropriate government departments, and good communications with groups that use the area and with officials of Parks Canada, also have the potential to minimize the impacts.

The Board is therefore prepared to approve Shell's application and issue the requested well licence. It will make the licence subject to the following conditions:

- Details of the drilling plan, particularly those items referred to in the report as needing further consideration, must be approved by the Board prior to spudding of the well.
- Immediate ignition of the well shall take place if there is a total loss of control at the well. The only time at which a small leak could go unignited would be if the Board is satisfied that control of the well is imminent and there is no threat to public safety.
- Details of the emergency response plan must be approved by the Board prior to spudding of the well.

The licence is being issued on the understanding that the following arrangements will be adhered to:

- The Jutland well will not proceed until the drilling results of the Grouse well are known and generally support Shell's geological interpretation of the region.
- No construction in the South Castle or Font Creek area will occur prior to the decision to drill the Jutland well.
- Shell will give consideration to the suggestions of Parks Canada regarding a bear-awareness program.
- Discussions will take place between Shell and government officials respecting the appropriate location for gate closures.
- The details of any limited testing of the well would be approved by the Board prior to the commencement of testing.
- Discussions will take place between Shell and the commercial outfitters and trappers in the area in an effort to better recognize their concerns and to minimize impacts on them. These will include the possible conflict regarding the location of base camps and the potential impact on trapping operations and will, where appropriate, include discussions with the appropriate government department.
- Shell will, while in the critical zone, inform the appropriate Board field office of its operations on a weekly basis.
- Shell will advise the Board field office immediately, by the quickest effective means, of any unusual drilling problems or occurrences.
- Shell will provide an opportunity for input on the emergency response plan from representatives of the commercial outfitters, the Town of Pincher Creek, Parks Canada, and other potentially impacted parties prior to submitting it to the Board in final form for approval.
- Operations will not take place in the critical zone during the peak tourist season from 15 June to 15 September.
- Shell will discuss with Parks Canada the appropriate awareness program for visitors to Waterton Park.

Additionally, the Board plans to discuss this decision report with appropriate government departments, particularly regarding the following matters which the Board considers to be beyond its jurisdiction:

- The possibility of increased on-site surveillance by appropriate government officials during the construction phase in an effort to further minimize potential impacts on the environment.
- The appropriate hunting, fishing, and poaching controls for the area.

- The appropriate gate location for access restriction.
- The question of appropriate maintenance, including snow removal, for the access road north of Scarpe Creek if the well is completed and left suspended for some period of time.

DATED at Calgary, Alberta, on 3 June 1986.

ENERGY RESOURCES CONSERVATION BOARD

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G. J. DeSorcy
Vice Chairman

LA Bellows

L. A. Bellows
Board Member

EJ Morin

E. J. Morin
Acting Board Member

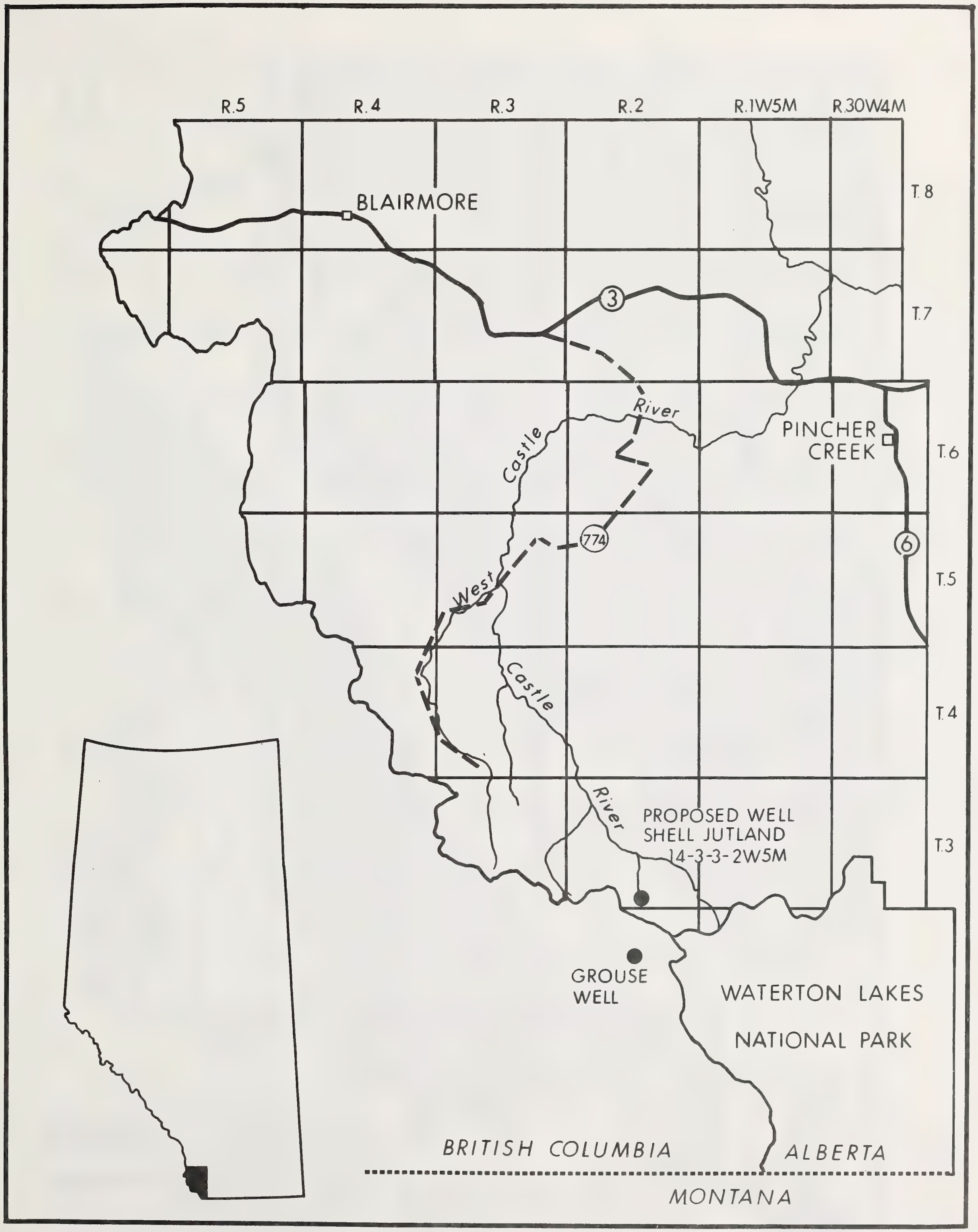

FIGURE 1–LOCATION OF THE PROPOSED JUTLAND WELL

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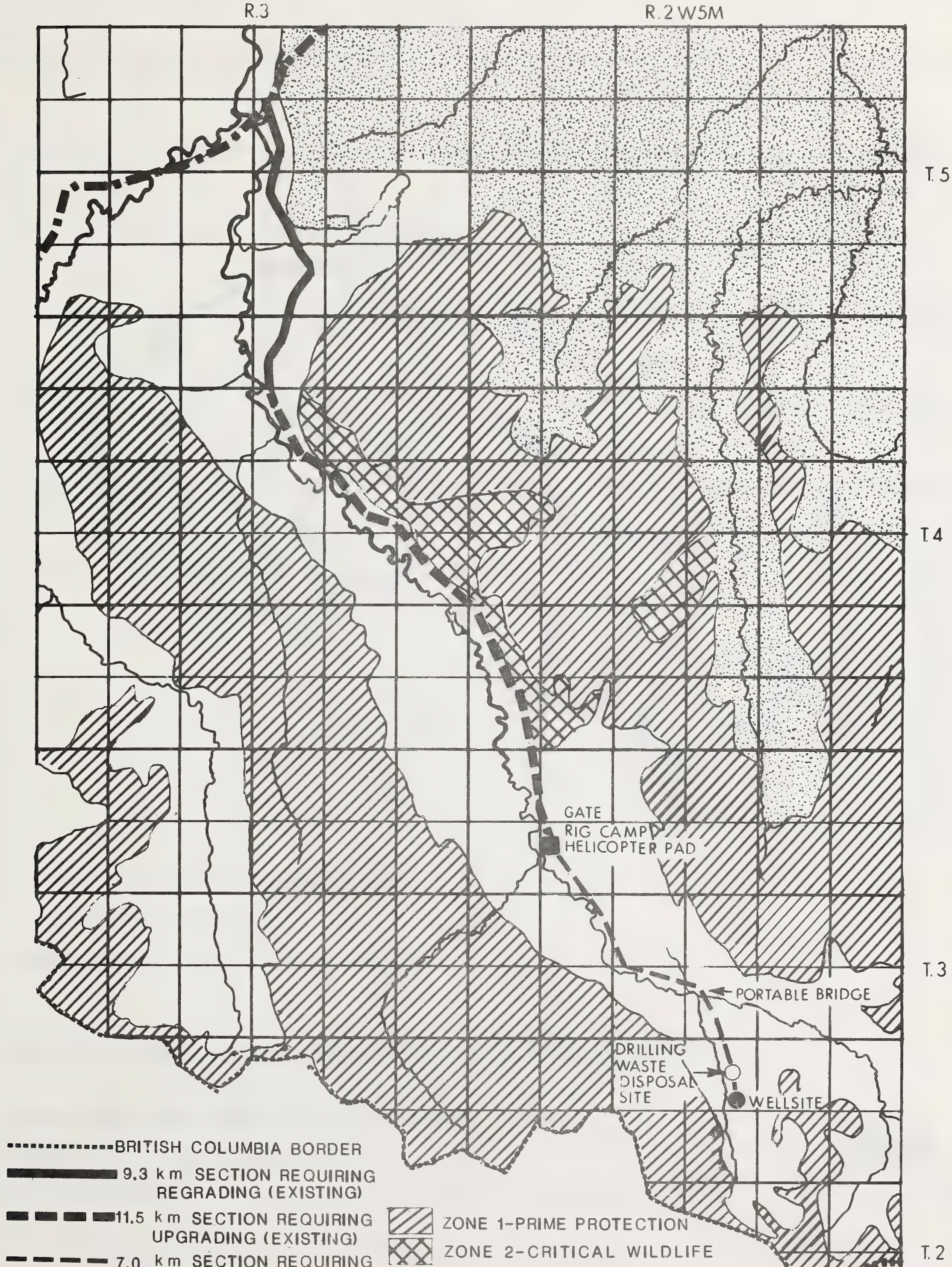
R.3
R.2 W5M
T.5
T.4
T.3
T.2
GATE
RIG CAMP
HELICOPTER PAD
PORTABLE BRIDGE
DRILLING WASTE DISPOSAL SITE
WELLSITE
WATERTON PARK
BRITISH COLUMBIA BORDER
9.3 km SECTION REQUIRING REGRADING (EXISTING)
11.5 km SECTION REQUIRING UPGRADING (EXISTING)
7.0 km SECTION REQUIRING REBUILDING (NEW)
HIGHWAY 774
ZONE 1-PRIME PROTECTION
ZONE 2-CRITICAL WILDLIFE
ZONE 4-GENERAL RECREATION
ZONE 5-MULTIPLE USE

FIGURE 2-LOCATION OF PROPOSED ACCESS ROAD AND CONSTRUCTION ACTIVITIES

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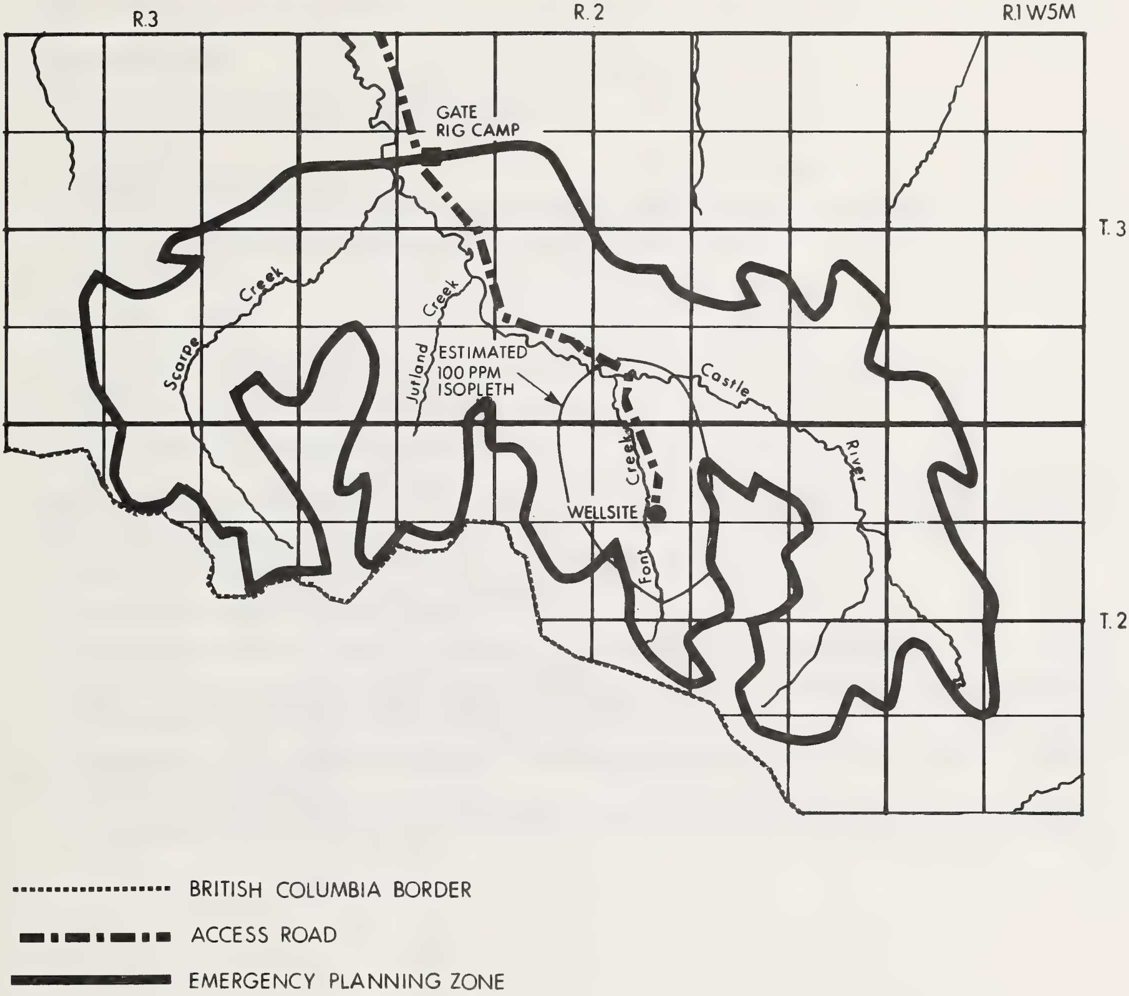

FIGURE-3 PROPOSED EMERGENCY PLANNING ZONE

ADOPTED FROM SHELL 14-3-3-2W5M
EMERGENCY RESPONSE PLAN

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APPENDIX 1—CHARACTERISTICS AND HEALTH EFFECTS OF H_2S AND $S0_2$

Characteristics of H_2S

- Found in rotten eggs, natural oil and gas, silos, sewers.
- Found as a gas at temperatures above -60°C.
- Colourless.
- Flammable—burns to form $S0_2$.
- Odour of rotten eggs at low concentrations—kills all sense of smell at higher concentrations.
- Will tend to disperse more slowly in sheltered or calm (eg low-lying) areas.
- Extremely toxic.

Characteristics of SO_2

- Formed by the combustion of H_2S, and is non-flammable.
- Found as a gas at temperatures above -75°C.
- Has the odour that occurs when a match is extinguished.
- Highly irritating—dissolves to form sulphuric acid.

The following tables on health effects were adapted from this list of sources. Many of the standards are currently under review, particularly in terms of the exposure averaging times, and some of those cited have been generalized.

1. Canada Safety Council Data Sheet "Hydrogen Sulphide", No. B-3.
2. Canada Safety Council Data Sheet "Sulphur Dioxide", No. B-4.
3. Alberta Provincial Board of Health "Guidelines for Action Regarding Hydrogen Sulphide".
4. National Research Council of Canada, "Hydrogen Sulfide in the Atmospheric Environment: Scientific Criteria for Assessing its Effects on Environmental Quality", publication #18467.
5. Alberta Public Safety Services "Government of Alberta Emergency Response Plan for a Sour Gas Release". Second and Third Editions.
6. Occupational Health and Safety Act. Chemical Hazards Regulation. Government of the Province of Alberta.

General Health Effects of H_2S* and Provincial Standards

CONCENTRATION (ppm)	HEALTH EFFECTS
0.01	1-hour Clean Air Act—Air Quality Standard (for avoiding nuisance levels).
0.01-0.3	Odour threshold, minimum concentration one can smell.
1	Voluntary evacuation for sensitive individuals if levels persist and are averaged over a 1-hour period.
1-5	Moderate to strong offensive odour. May experience nausea, tearing of the eyes, headaches, or loss of sleep following prolonged exposure. Effects are reversible and not serious.
5	Voluntary evacuation for individuals without pre-existing health problems but who experience difficulty. Evacuation should normally occur only if levels persist and are averaged over several hours.
10	8-hour Occupational Exposure Limit
15	15-minute Occupational Exposure Limit
20	Ceiling Occupational Exposure Limit Urgent evacuation will be advised if these concentrations are experienced for even a few minutes.
20-50	Can increase eye and lung irritation. May cause eye damage after several days of exposure. May cause digestive upset and loss of appetite.
50-150	Increased eye and lung irritation.
150-300	Kills sense of smell. Severe eye and lung irritation.
300-500	Dangerous, loss of smell within 30 minutes.
500-700	Serious damage to eyes within 30 minutes. Severe lung irritation. Life threatening—death within 4 to 8 hours.
700-1000	Breathing stops within one or two breaths. Life threatening—death within 30 minutes to 1 hour.

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* See above references.

General Health Effects of SO_2* and Provincial Standards

CONCENTRATION (ppm)	HEALTH EFFECTS
0.17	1-hour Average Clean Air Act—Air Quality Standard (for avoiding vegetation damage).
0.3	Evacuation suggested if levels persist and averaged over a 24-hour period.
1.0	Evacuation suggested if levels persist and averaged over a 3-hour period.
2	8-hour Average Occupational Exposure Limit.
3-5	Odour threshold.
5	15-minute Average Occupational Exposure Limit. Evacuation recommended if these concentrations are experienced over several minutes.
8-12	Throat irritation, coughing, constriction in the chest, tearing and smarting of the eyes.
10-50	After 5-15 minutes exposure: increased irritation of the eyes, nose, throat, choking, coughing, and in some cases wheezing as a sign of narrowing of the airways (which increases the resistance of the airflow).
150	Short-term endurance due to severe eye irritation and because of the effects on the membranes of the nose, throat, and lungs.
500	Highly dangerous after an exposure of 30-60 minutes.
1000-2000	May be fatal with continued exposure.

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* See above references.

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